BULLETIN OF
UNDERGRADUATE STUDIES

1977-1978

CONTINUING EDUCATION
EVENING SCHOOL

OFFICIAL REGISTER OF THE UNIVERSITY OF LOWELL

CONTINUING EDUCATION

EVENING SCHOOL
OFFICE: Lower Level, Cumnock Hall
CALENDAR 1977-1978

FIRST SEMESTER (Sept. 1977)

August 29, 30, 31; September 1; 6:30-8:00 p.m. Monday through Thursday	Registration
September 6, Tuesday	Classes Begin
October 10, Monday	Columbus Day Holiday
November 11, Friday	Veterans Day Holiday
November 24 and 25 Thursday and Friday	Thanksgiving Recess
December 20	End of First Semester

SECOND SEMESTER (Jan. 1978)

January 9, 10, 11, 12; 6:30-8:00 p.m. Monday through Thursday	Registration
January 16	Martin Luther King Day
January 17, Tuesday	Classes Begin
February 20, Monday	Washington's Birthday
April 17, Monday	Patriot's Day Holiday
April 27	End of Second Semester
June 3	Commencement

SUMMER SESSION (May 1978)

Dates will be available in the Summer Evening Bulletin (April 1978)

YEAR 1978-1979
FIRST SEMESTER (Sept. 1978)

August 28, 29, 30, 31; 6:30-8:00 p.m. Monday through Thursday	Registration
September 5, Monday	Classes Begin

1977-1978 CLASS MEETING SCHEDULE

The Evening School class meeting schedule for 1977-1978 (see inside back cover) provides for the completion of the first semester prior to the Christmas recess and the completion of the second semester before May 1, 1978.

This rearrangement of class schedules provides the Evening School student an opportunity to accelerate his progress toward a degree thereby shortening the period of time to complete the graduation requirements.

UNIVERSITY of LOWELL
ALUMNI/LYDON LIBRARY

BULLETIN OF UNDERGRADUATE STUDIES

1977-1978

CONTINUING EDUCATION EVENING SCHOOL

Published by the University of Lowell, 1 University Avenue, Lowell, Massachusetts 01854

The rules and regulations published in this bulletin were in effect at the beginning of the 1976-1977 academic year and are subject to change through established procedures of the University. Changes in academic rules and regulations are effective at the beginning of the academic year following their adoption. Listings of course offerings are subject to change by concerned departments and University administrators in the event that unforseen faculty changes have taken place or insufficient numbers of students have subscribed to course offerings. The official schedule of course offerings for each semester is provided in the *Schedule of Classes,* which is published biannually by the Evening School.

The University of Lowell is an Equal-Employment, Affirmative-Action University and does not discriminate in admissions or employment on the basis of sex in compliance with Title IX. Any inquiries concerning Title IX should be directed to the Title IX Coordinator or the Director of the Office of Civil Rights.

This educational material is printed at no expense to the Commonwealth of Massachusetts.

TABLE OF CONTENTS

Academic Calendar........ Inside Back Cover
Evening School Administration........ 3
General Information........ 4
General Policies........ 6
Registration Information........ 7
Admission Information........ 9
Tuition and Fees........ 10
University Requirements for Baccalaureate Studies........ 11
Grading Information........ 12
Graduation Information........ 16
Course Equivalency Procedures........ 19

Major Programs

Accounting........ 20
Banking........ 22
Information Systems........ 24
Management........ 26
Public Service-Police Science........ 28
Public Service-Corrections Administration........ 30
Applied Chemistry........ 32
Applied Mathematics-Scientific Data Processing........ 34
Applied Mathematics........ 36
Medical Technology........ 38
Nursing........ 40
Civil Engineering Technology........ 42
Electronic Engineering Technology........ 44
Industrial Engineering Technology........ 46
Mechanical Engineering Technology........ 48
Industrial Technology-Manufacturing Option........ 50
Industrial Technology-Water and Waste Option........ 54

Course Descriptions

Accounting........ 56
Economics........ 57
Banking........ 58
Management........ 59
Chemistry........ 61
Science........ 63
Mathematics........ 65
Computer Science........ 68
Civil Engineering Technology........ 71
Electronic Engineering Technology........ 73
Industrial Engineering Technology........ 79
Mechanical Engineering Technology........ 81
Industrial Technology........ 84
Plastics........ 86
Clinical Laboratory Science........ 87
Medical Technology........ 89
Nursing........ 91
Criminal Justice........ 94
Behavioral and Social Sciences (Area I)........ 97
Fine Arts and the Humanities (Area II)........ 101

CL4
LD
3131
.L62
A14 1977-78 UndergrAD
0005348102

CONTINUING EDUCATION
EVENING SCHOOL

Ernest P. James, B.T.C., M.S.	Director of Continuing Education
David H. Pfister, B.S., M.S., P.E.	Assistant Dean for Continuing Education
Aristomenes G. Panos, B.S. in B.A., M.Ed.	Assistant Director of Continuing Education

PROGRAM CO-ORDINATORS

Accounting, Banking, Management	**Santo J. Pullara,** B.S., M.B.A., J.D., Ph.D.
Chemistry	**Phillip S. Lamprey,** B.S., Ph.D.
Civil Engineering Technology	**William E. Haskell, Jr.,** B.S., M.S., Ph.D., P.E., R.L.S.
Data Processing, Information Systems	**Ann Marie Hurley,** B.A.
Electronic Engineering Technology	**J. Robert Lemieux,** B.S., M.S.
General Studies	**Donald R. Berry,** A.B., M.A.
Industrial Engineering Technology	**Robert J. McVicker,** B.S., M.S.
Industrial Technology	**Robert J. McVicker,** B.S., M.S.
Mathematics	**Alan W. Doerr,** B.A., M.A.
Mechanical Engineering Technology	**Frederick B. Bischoff,** B.S., M.S., P.E.
Medical Technology	**Joseph P. Farina,** B.S., M.S., M.S.Ed., Ph.D.
Nursing	**Norma McQuaid,** B.S., M.S.

STAFF

Emma M. Millett, Secretary

Marguerite H. McGarry, Secretary

Michelle A. Fournier, Secretary

Elizabeth A. Saucier, Secretary

Tanya A. Kyslowsky, Secretary

GENERAL INFORMATION

History and Aims

The University of Lowell welcomes your interest as a prospective student. While a "new" school, by virtue of 1973 Massachusetts legislation, the University is actually a merger of two recognized institutions—Lowell State College and Lowell Technological Institute.

The two institutional components of the University of Lowell represent a 161 year contribution to higher education begun in the 1890's. Lowell State College was one of the best schools for teacher training in the Commonwealth and Lowell Tech had its early origins as a textile school.

Administration, faculty and resources of the two co-educational schools are now combined, resulting in seven colleges, a graduate school, and continuing education facilities on a 100-acre campus.

The major aims of the University of Lowell are to furnish sound educational programs at both the undergraduate and graduate levels, to cultivate in its students a professional attitude in their fields of concentration and to develop their ability for creative thinking. All education, and particularly in the fields of study offered at the University, must be based on a thorough grounding in the fundamentals upon which the study in the area of specialization is built; but, it must prepare the student for life in general and thus there must be an emphasis on the development of self-reliance and awareness of the inter-relation between science, technology and industry and the society in which we live. Graduates are prepared to enter the fields they have chosen or to continue for further education in graduate schools in preparation for research, teaching, or industrial positions.

Facilities of the University

The buildings on the University of Lowell campuses represent an investment in the area of 100 million dollars. Most of the construction has been completed in the last 15 years.

Laboratories, auditorium and lecture rooms, and a 1 megawatt research nuclear reactor are the most recent academic additions to the North campus, visible at Everett V. Olsen Hall, Olney Science Center and the Pinanski Nuclear Center.

At the South campus an impressive student union complex, cafeteria and facility housing the Daniel H. O'Leary Library are outward signs of the recent progress at the University. A multi-use music building, Cyrus Durgin Hall, features recital halls and a major auditorium for symphonic and operatic productions.

Dormitory residences range from smaller, formerly residential homes to larger scales, including an 18-story high rise on the North campus.

Two library centers serve the University and maintain a growing collection of about 250,000 volumes and periodicals. There are, additionally, a variety of special resources at both libraries including listening rooms, media center services, reference and audio-visual departments.

Continuing Education

Continuing Education involves all programs, other than the usual undergraduate and graduate offerings, for students whose primary immediate concern is something other than full-time education. Both credit and non-credit programs are in formats principally designed for full-time workers who desire a college education, in-service teachers, professional personnel, housewives, and others in the community who seek educational fulfillment. Continuing Education is a unique and integral part of the total University structure with no invisible barriers between day and evening hours or among the four seasons. It is a completely flexible concept of education, offering all the different programs required to fulfill community and industrial needs, from one-day seminars to workshops, to non-credit and credit offerings, to fully developed degree-granting programs designed to fit a specific professional advancement need.

Evening School

The Evening School has developed a broad spectrum of subject offerings to fulfill the educational needs of employed persons and others in the Merrimack Valley area who are restricted to part-time attendance. Priority and sequence schedules cater to vocational and professional career development, with emphasis on updating and modifying the individual's occupational preparation base. The matching of academic program with systematic job progress over a period of years provides for a total development of the individual in quest of professional advancement.

College level evening programs provide a variety of opportunities for matriculation. Transfer students (community colleges and other post-secondary institutions), veterans, and students who provide academic credentials such as the College Level Examination Program, comprise the majority of evening registrants.

Graduate School

The University of Lowell offers advance studies, including professional training and research, leading to graduate degrees in engineering, science, education, music and management.

In addition to the day classes intended primarily for full-time graduate students, the Graduate School offers some evening classes through the Evening School mainly for the convenience of part-time students. The courses offered in the evening are equivalent in every respect to those offered to full-time graduate students. The following are offered through the Evening School: Master of Mathematics for Teachers, Master of Science in Plastics, Computer Engineering, Electrical Engineering and Systems Engineering.

For further information concerning all graduate programs please consult the Graduate School Catalog. All inquiries concerning Graduate programs should be addressed to the Graduate School, University of Lowell, Lowell, Massachusetts, 01854.

Accreditation of the University

The accreditation and academic status of the University of Lowell includes a combination of those received by earlier components, Lowell State College and Lowell Technological Institute. Graduates of the schools have been accepted for advance study at nearly all major universities.

The University is accredited by, or a member in good standing of, the following:

New England Association of Schools and Colleges
College Entrance Examination Board
American Council on Education
Association for State Colleges and Universities
National League of Nursing (College of Health Professions)
National Council for Accreditation of Teacher Education
    (undergraduate programs in elementary, music and secondary education)
American Association of Colleges for Teacher Education
Engineers' Council for Professional Development
    (chemical, electrical, mechanical engineering, civil engineering technology)
American Chemical Society
National Association for Schools of Music

GENERAL POLICIES

Policy Changes

The University of Lowell reserves the right to change requirements, subjects, courses, regulations, and other policies stated in this catalog without formal notice.

Inclement Weather

The inherent difficulties in notifying all the Evening School student body and instructors in sufficient time results in the policy that the Evening School will not be closed for reasons of weather.

Special Students

Students who wish to register for single subjects in the Undergraduate Degree Programs may do so provided they have the necessary prerequisites. These subjects will be taken on a credit basis and tuition will be charged at the regular rate.

Attendance

Students must attend 80 percent of all classes held. More than three unexplained absences may cause a student to be dropped from the rolls and a grade of "F" assigned to the subject. Examinations or other work missed by absence may be made up or failed at the option of the instructor.

Federal Benefits

All Veterans entitled to educational benefits under the Federal Law should secure a Certificate of Eligibility from the Veterans Administration. Application forms may be obtained from the Evening School Office or the local V. A. office. In addition, all Veterans must submit a high school transcript and a transcript of all post-secondary education before registering in any program.

Veterans Administration representatives are available at the University.

Student Responsibility

In some instruction the students are required by law to wear safety glasses. The instructor for such classes will inform the students of their obligation to obtain and wear the required safety protection.

Students must pay for any breakage or damage of school equipment that they may cause, provided that such breakage or damage does not occur while the student is under direct supervision of his instructor.

To be admitted to and enrolled in a scheduled class, students must present the validated class cards received from the bursar.

The identification card must be carried by the student on his person while attending school. It is the responsibility of the student to become familiar with the scholastic regulations in regard to attendance, scholastic standards, withdrawals, etc. as outlined in this bulletin. An administrative assistant is assigned to the Evening School Office from 6:30 - 10:00 p.m. throughout the school year to advise students.

A student may be dropped from the rolls of the Evening School whenever it is considered in the best interests of the Institute.

REGISTRATION INFORMATION

Preliminary Registration

Applicants and students are encouraged to submit specified preliminary registration forms prior to the scheduled registration dates. Since no payment of fees is involved, the student will NOT be considered as registered at this time and must therefore complete the process of registration by payment **in full** the amount due during the scheduled registration period. The preliminary procedure may provide the student with an opportunity to request a choice of night for attendance and will expedite the registration procedure.

Scheduled Registration

Students may register by filling out the necessary forms and paying the required fees before attending classes. Registration is held on the dates indicated in the calendar (inside front cover). On those days the Bursar's Office is open from 6:00 to 8:30 p.m. **A student is not registered until all tuition and**

fees have been paid and individual class cards have been validated by the Bursar. These cards are required for admittance to class; in addition, the Bursar will issue a numbered receipt. Students must obtain an identification card during this registration period.

Late Registration

Late registration is permitted for a limited period by payment of the late registration fee. **No new registration or class changes are accepted after the end of the second week of classes.**

Summer Program

Selected subjects may be offered during the summer session. The subjects offered will depend upon student demand and may vary from year to year. For each subject taken, students will receive full credit on the same basis as for work done during the fall or spring semester. Costs and other information will be available at the Evening School Office prior to the start of the summer session.

Program Planning

Assistance in program planning and admissions is available during the scheduled registration period each semester; **however it is strongly recommended that the preliminary registration phase be accomplished prior to the scheduled registration period.** General guidance is available for curriculum planning throughout the school year while classes are in session. An administrative assistant is available at the Evening School Office. Appointments for conferences may be made.

Class Schedule

Classes in the Undergraduate Degree Programs are scheduled on Monday, Tuesday, Wednesday, Thursday and Friday evenings as listed in the schedule on the inside of the back cover of this catalog, from 7:00 p.m. to 10:00 p.m. Other hours are sometimes scheduled in individual subjects, in which cases the hours are listed with the subject descriptions. Saturday classes may also be scheduled.

Size of Class

Those classes which do not register a minimum of 15 students may be cancelled.

Books and Supplies

Students must provide their own books, paper, drawing materials, and other supplies. Student supplies will be sold by the University's bookstore at scheduled times in the evening. The schedule is posted on the Evening School bulletin board.

Transfer Credit

If a student wishes to request transfer credit, he must complete, in duplicate, a form entitled "Request for Transfer Credit." This form must be filed at the student's first registration.

Credit will be allowed for work which has been done elsewhere at accredited colleges and which is equivalent in scope and which has been passed with a grade equivalent to a "C" grade at the University of Lowell.

No grade for work successfully completed at these other institutions will be considered in computing a student's cumulative rating. Transfer subjects will be merely recorded with the notation "Cr." A student must submit a record of grades for work done elsewhere. It is his responsibility to submit to the Evening School an official transcript, together with a catalog or subject description.No request for transfer credit will be considered until all the required material has been submitted.

The University of Lowell has affirmed its intention to maintain flexibility in the transfer of qualified students of the Commonwealth of Maassachusetts. For the implementation of this objective, the University of Lowell has subscribed to the Massachusetts Transfer Compact.

Courses completed at non-public institutions which are not accredited by the major regional accrediting associations may not be credited to degree programs of the University; nor may courses be credited to baccalaureate programs of the University which were completed through extension or adult-enrichment programs or post-secondary school diploma programs, which have been taken more than ten years prior to the date when a student applies for transfer, or which are unacceptable to the transfer institution for its associate or baccalaureate programs. However, such competencies as may have been achieved by a student through courses which are unacceptable for transfer may be recognized by the University through procedures for advanced placement with course credit through examinations

ADMISSION INFORMATION

General Requirements

All Undergraduate Degree programs offered by the Evening School require for entrance, graduation from a recognized high school or a Massachusetts High School Equivalency Certificate or equivalent. Each student must submit his high school transcript or equivalency certificate prior to registration. In addition, the following entrance requirements must be met:

Business and Public Service Programs

Two years of mathematics of which one year must be algebra.

Technology and Science Programs

A minimum of two years of mathematics with one year of algebra and one year of plane geometry.

Medical Technology Program

ASCP Certification (C.L.A. or M.L.T.) is required for admission to the Medical Technology program.

Nursing Program

Licensure as a registered nurse is required for admission to the Nursing program. It is recommended that all applicants have two years of mathematics, including one year of algebra. Students not having this background should seek guidance prior to registering for the computer and statistics subjects.

Matriculation

In order to be matriculated it is necesary for the student to demonstrate ability to participate in college level classes, in addition to satisfying the entrance requirements. Matriculation in a degree program is effected upon the satisfactory completion of a minimum of 18 credits in required subjects. A student must request matriculation by completing the necessary form. One credit is one class hour per week per semester.

Matriculation in the Medical Technology Program

Matriculation is effective upon the satisfactory completion of 18 credits in required subjects with "C" or better. One credit is one class hour per week per semester. Students must achieve an overall grade point average of 2.5 prior to admission into the upper division (years 5 to 7) with no grade less than "C" in the prerequisites and Clinical Laboratory Science courses.

In order to be recommended for graduation, the Medical Technology students must satisfactorily complete all Clinical Laboratory Science courses with "C" or better and their cumulative grade point average must be at least 2.5. Students must complete a minimum of 36 credits in the Evening School in the programs in which the degree is to be granted.

Matriculation in Nursing Program

Matriculation is effective upon the satisfactory completion of 18 credits in required subjects with a "C" or better. Students must achieve an overall grade point average of 2.5 by the end of the fourth year of required subjects. These subjects must be completed prior to enrolling in the nursing subjects in years 5 and 6. In order to be recommended for graduation, Nursing students must then maintain a cumulative grade point average of 2.5 throughout the remainder of the program.

TUITION AND FEE INFORMATION

Registration Fee and Insurance Fund

A payment of $5.00 per semester is required of all students for registration and compulsory insurance, in addition to tuition and other charges. This payment is not refundable.

The above compulsory fee, approved by the Board of Trustees of The University of Lowell, includes an accidental medical insurance plan to cover registered students in the Evening School while on the premises of the Institute for scheduled instruction and while engaged in any supervised activity sponsored by the Evening School. Payment will be made for medical expenses from such accidents up to a maximum of $1,000. Claim forms must be obtained from the Evening School Office and taken to the doctor or hospital at the time of treatment. Benefits are paid directly to the medical facility.

Late Registration Fee

A late registration fee of $10.00 is charged any student who registers after the regular registration dates as listed in the calendar. This fee is in addition to the normal registration and insurance fee.

Laboratory Fee

A $10.00 laboratory fee is charged any student who registers for a laboratory class. This payment is not refundable.

Tuition

Tuition charges are $22.00 per credit hour for a lecture course and $22.00 per weekly contact hour for a laboratory course.

Refunds

Students withdrawing from a class prior to the first class meeting are entitled to a 100% refund of tuition. Students withdrawing from a class prior to the second class meeting are entitled to a 50% refund of tuition. No refunds will be made after the second class meeting.

A student must file an application for refund on the form provided at the Evening School Office. The registration and insurance fee of $5.00 and the late registration fee of $10.00 will not be returned in any case unless the class is cancelled.

UNIVERSITY REQUIREMENTS FOR BACCALAUREATE STUDIES

All baccalaureate candidates are required to obtain 2.00 ("C") cumulative averages in their total courses of study, to present a minimum of 120 semester hours of course credits to fulfill the residency requirement of one year of full-time study, to conform to the general regulations and requirements of the University, to satisfy the regulations and academic standards of the colleges which exercise jurisdiction over the degrees for which they are matriculating, to satisfy the curriculum requirements established by the departments or programs in which they are majoring, and to complete the following core requirements of thirty-three (33) semester credits.

University Core Requirements

1. English Composition Requirement (six (6) semester credits).

All students must pass a sequence of two courses totaling six semester credits in English Composition (normally to be taken during the freshman year).

2. Area Distribution Requirements (twenty-seven (27) semester credits).

All students must select and pass a minimum of nine courses and twenty-seven semester credits outside their major departments in three basic areas of the liberal arts and sciences. A minimum of two courses and six semester credits must be presented in **each** of the three areas and an additional three courses and nine semester credits must be presented from **among** the three basic areas. In fulfilling the Area Distribution Requirements, students may not present more than three courses and nine semester credits from the offerings of any one department (except that they may not present more than two courses and six semester credits from the offerings of the English Department) and may not present more than four courses and twelve semester credits in any one distribution area.

AREA I: Behavioral and Social Sciences

Economics, Geography (non-laboratory courses), History, Political Science, Psychology, and Sociology

AREA II: Fine Arts and the Humanities

Art, English, Languages, Music, and Philosophy

AREA III: Mathematics and the Sciences

Astronomy, Biology, Chemistry, Earth Sciences (Geography laboratory courses, Geology, Meterology), Mathematics and Physics

GRADING INFORMATION

Grading System

The following qualitative letter grades are employed by the University to characterize the quality of a student's work in a course:

"A" designates that the work done by the student is superior and is of the highest honors quality; 4

"AB" designates that the work done by the student is less than superior but is completed with a level of distinction which is higher than the basic honors level; 3.5

"B" designates that the work done by the student in less than honors quality; 3

"BC" designates that the work done by the student is less than honors quality but is better than satisfactory; 2.5

"C" indicates satisfactory work which conforms to the general expectations of the University for baccalaureate study; 2

"CD"	indicates that the work done by the student is less than satisfactory and below graduation standards but is better than the minimum requirement for passing a course;	1.5
"D"	indicates work which meets the minimum requirement for passing a course;	1
"F"	designates course failure.	0

In addition to the above letter grades, the following symbols are also used to designate special enrollment provisions or course statuses and do not affect the student's academic average:

"P"	designates completion of a course taken on a "pass-no credit" basis;
"NC"	indicates failure of a course taken on a "pass-no credit" basis;
"S"	designates satisfactory completion of a practicum experience course with a grade of "C" or higher;
"U"	indicates unsatisfactory performance in a practicum experience course with a final course grade of less than "C";
"I"	indicates a course which has not been completed;
"W"	designates official withdrawal from a course within the established deadline.
"AU"	designates that the student has registered for a course on an "audit" basis and has maintained an attendance record throughout the semester which is sufficient to warrant an official recognition of his course attendance.

WITHDRAWAL

"W" is not an academic grade but a symbol designating official withdrawal from a course within the established deadline of the eighth (8) week of class of a semester or authorized retroactive withdrawal from a course after the eighth week of classes. A notation of "W" may not be authorized for unofficial withdrawal from a course or for unofficial withdrawal from the University. Accordingly, a student who registers for a course and who is carried on an official class roster after the eighth week of a semester must be graded in terms of his completion of an instructor's total course requirements although he fails to attend any class meeting or unofficially absents himself from the course prior to the eighth week of a semester. Course withdrawal after the withdrawal deadline of the eighth week of a semester may be authorized only when extended illness or critical personal emergencies of an extended nature have prevented a student from complying with withdrawal procedures. A student who wishes to withdraw from a course after the eighth week of classes must submit a petition to the Evening School Office. If approval is given for retroactive withdrawal, the student will be awarded a "W". **Students receiving benefits from the Veterans Administration are not eligible for retroactive withdrawal from courses** since the University is required to report immediately any change of enrollment status for such students to authorities of the Veterans Aministration.

Incomplete

If the work for a subject in which an "I" grade is given is not completed within the four week period following the final examination, the "I" grade will automatically become an "F" grade. **Taking the initiative to remove an Incomplete or other academic deficiency in his record is the responsibility of the individual student.**

Student's Rating

The quality point values above, when multiplied by the credits assigned to the subject and added together, are divided by the sum of the credits to give the student's grade point average. The cumulative rating for more than one semester is obtained in the same manner as the computation for the rating of a single semester. The grade of "W" carries no credits.

Repeated Course Work

Students must repeat and pass all required courses which they have failed. Failed courses must be repeated and passed before students may take courses for which those failed are prerequisites. A course which is failed but is not required for the student's program need not be repeated, but other course work must be undertaken when a student's total degree program will fall short of the specific credit hours for degree requirements.

Students may repeat a limited number of courses in which they receive grades of "CD", "D", and "F" and have the repeated grades substituted for the original grades on the computation of their cumulative grade-point averages. Computation of the grade-point average is made on the basis of whatever grade, higher or lower, is received for the repeated course. Students entering as freshmen or transferring with less than 60 semester credits are permitted a maximum of 10 credits of course repetition for substitution; students transferring with 60 or more semester credits are permitted a maximum of 7 credits of course repetition for substitution. Courses repeated in excess of the maximum credits may be used to "clear" failed courses only but both grades will be used in determination of the grade-point average. Students must designate, by petition, which courses are being repeated for the purpose of grade substitution prior to retaking the course.

Academic Standing

Each student is subject to the following grade-point requirements for the specified numbers of completed course hours:

Course Hours Completed*	Grade-Point Averages for Satisfactory Standing+	Grade-Point Averages for Academic Warning+	Grade-Point Averages for Academic Suspension+
12-30	1.50	1.40-1.49	1.39 or below
31-45	1.60	1.50-1.59	1.49 or below
46-60	1.70	1.60-1.69	1.59 or below
61-75	1.80	1.70-1.79	1.69 or below
76-90	1.90	1.80-1.89	1.79 or below
91-graduation	2.00	1.90-1.99	1.89 or below

The cited grade-point averages are minimum University requirements. Individual colleges or departments may establish higher requirements.

*Included in "Course Hours Completed" are all course credits which have been granted (including credits awarded through transfer and challenge by examination, course credits which have been awarded with qualitative letter grades) and all hours of course work which have been failed with the qualitative letter grade of "F".

+Specified "Grade-Point Averages" are computed solely on the basis of those courses completed at the University of Lowell or through University auspices within policies governing authorized off-campus study which have been qualitatively evaluated with the following letter grades: "A", "AB", "B", "BC", "C", "CD", "D", and "F".

Prior to an initial determination of academic progress a student may not repeat courses for grade substitution.

A student who has been placed on academic warning must reach satisfactory standing upon the completion of 15 additional hours of course work or is suspended from the University.

A student who is suspended from the University may apply for readmission as a probationary student but must be absent from the University for one semester before applying for readmission. A student must petition, in writing, for readmission, and if accepted, must meet the requirements established for readmission. The student may not withdraw from a course undertaken as part of his probationary studies without prior approval, may not repeat a course for grade substitution during this period, and must reach satisfactory academic standing by the end of the probationary period.

Students who achieved sophomore class standing by January 1, 1976 are exempt from the new grade-point requirements until they achieve junior class standing, but in no case later than the end of the Spring Semester 1978. Students who have achieved junior or senior class standing by January 1, 1976 are exempt from the University grade-point averages through the end of the Spring Semester 1980.

All students who are exempted from the grade-point requirements of the University for the above specified periods are subject to the following grade-point requirements.

Course Hours Completed*	Grade-Point Averages for Satisfactory Standing+	Grade-Point Averages for Academic Warning+	Grade-Point Averages for Academic Suspension+
31-45	1.45	1.35-1.44	1.34 or below
46-60	1.50	1.40-1.49	1.39 or below
61-75	1.55	1.45-1.54	1.44 or below
76-90	1.60	1.50-1.59	1.49 or below
91-105	1.65	1.55-1.64	1.54 or below
106-	1.70	1.60-1.69	1.59 or below

*Included in "Course Hours Completed" are all course credits which have been granted (including credits awarded through transfer and challenge by examination, course credits which have been awarded with qualitative letter grades) and all hours of course work which have been failed with the qualitative letter grade of "F".

+Specified "Grade-Point Averages" are computed solely on the basis of qualitatively graded courses which have been completed at Lowell State College, Lowell Technological Institute, and the University of Lowell.

Determination of Undergraduate Class Standing

Freshman Standing	0-29 semester credits
Sophomore Standing	30-59 semester credits
Junior Standing	60-89 semester credits
Senior Standing	90 or more

GRADUATION INFORMATION

Commencement Fee

This fee of $25.00 applies to graduating students only and is payable on or before registration for the final semester in which the student qualifies for his degree. It covers such expenses as degree form and case, rental of cap and gown, invitations, printing, and any other expenses approved or directed by the President.

Graduation Interview

It is the responsibility of each student to arrange for a graduation interview at the Office of the Evening School early in the first semester of the school year in which he plans to qualify for his degree. A subsequent interview may be required early in the second semester.

University Honors

The University awards degrees with three levels of distinction at commencement upon those graduating students who have exhibited exceptional scholastic records. To be eligible for honor at graduation, each student must achieve a minimum grade-point average of 3.00 for all courses completed at the University (or through its auspices under regulations which govern authorized off-campus course work) and must have earned a minimum of 60 semester credits at the University (or through its auspices under regulations which govern authorized off-campus course work) as upperclass students or a minimum of 30 semester credits for the Associate Degree. Additionally, the record of each student must qualify him for the precentile distribution cited below as applied by each college to its total number of graduating students.

Summa Cum Laude	99th through the 98th percentiles
Magna Cum Laude	97th through the 90th percentiles
Cum Laude	89th through the 75th percentiles

Each college will calculate and publish each fall the distribution of gradepoints achieved by graduates in the three preceeding classes. Based upon this distribution, students must have grade-points at graduation in the cited percentile ranges.

Honors in Major Fields

In addition to honors which are awarded by the University, honors in major fields may be awarded by the colleges in which students are enrolled or (in the case of Continuing Education students) by the colleges which exercise academic jurisdiction over the programs in which they are enrolled. Recommendations for such honors are made by the faculty of the student's major department (or by interdisciplinary committees which exercise academic jurisdiction over the student's major studies) for outstanding achievement in the major field. In order to qualify for such honors, the student must fulfill the following requirements:

Complete a minimum of 24 credits in the major field at the University of Lowell;

Fulfill any honors requirements as specified by colleges, departments, or interdisciplinary committees in the major field; and

Achieve a grade-point average as specified below.

High Honors	4.00 in all courses which are taken in the major field at the University of Lowell
Honors	3.50 to 3.99 in all courses which are taken in the major field at the University of Lowell with no course grade in such courses less than "B"

Recognition of honors in the major field shall be noted on the permanent record cards of students and upon baccalaureate diplomas and shall be recorded as "High Honors in (major specified)," and "Honors in (major specified)."

Alumni Association

Associate Degree and Baccalaureate Degree students in the senior year of their respective Evening School programs of study are eligible for membership, and may become active members by filing application with the Association, and shall be entitled thereby to vote and hold office in the Association.

ENGINEERING TECHNOLOGY CURRICULA

Engineering Technology is that part of the technological field which requires the application of scientific and engineering knowledge and methods combined with technical skills in support of engineering activities.

The engineering technology curricula outlined in this catalog are planned sequences of college-level courses, leading to an associate or baccalaureate degree designed to prepare students to work in the field of engineering technology. The graduate of an associate degree program is generally known as an engineering technician and the graduate of a baccalaureate program is generally known as an engineering technologist.

The Engineering Technology Programs are supervised by a Program Faculty composed of full time and part time faculty. The coordinator of each Program Faculty sits on the Engineering College Council together with the Department Chairman.

Program Faculties

Civil Engineering Technology

William E. Haskell, Jr., Coordinator
Donald G. Leitch
William B. Moeller
Jeremiah F. Murphy
Donald S. Pottle
John J. Sewell
Herman T. Shea

Electronic Engineering Technology

J. Robert A. Lemieux, Cooordinator
Ronald D. Brunelle
George P. Cheney
Robert J. Dirkman
Martin A. Patt
James E. Powers
Stephen J. Spurk
David P. Wade

Industrial Engineering Technology

Robert J. McVicker, Coordinator
H. Jack Apfelbaum
Frederick B. Bischoff
Brian R. Caputo
Bernard C. Harcourt
Robert D. Hookway

Mechanical Engineering Technology

Frederick B. Bischoff, Coordinator
Robert Z. Hollenbach
Jon R. Kelly
Bernard L. Killion
William P. Mahoney
John A. McElman
Robert J. McVicker
Eugene E. Niemi, Jr.

COURSE EQUIVALENCY PROCEDURES

Students may apply for course equivalency credits up to a maximum of 30 credits; however, the total equivalency credits and transfer may not exceed 90 credits for the baccalaureate degree.

Course equivalency credits may be taken through CLEP examinations or departmental examinations. Departmental examinations will not be given if a corresponding CLEP examination is available.

Students may not request course equivalency credits for courses which the student has audited, failed, or withdrawn, nor in a course for which any substantial portion has previously been covered and for which the University has granted credit.

Departments reserve the right to refuse the granting of credit by examination for those courses which are presented by a student for his major.

Students interested in taking CLEP examinations must obtain approval prior to taking the examination from the program coordinator.

The Evening School in cooperation with the Council on College-Level Examinations of the College Entrance Examination Board has developed its own normative data for setting standards for awarding credit. Evaluation of Subject Examinations and General Examinations together with other credentials is still decided by the Academic Policy Committee. Generally, credit based on CLEP Subject Examinations is granted to individuals who earn scores at or above the mean score for C students on the CLEP national norms.

The Evening School is in full accord with the principle of affording an opportunity for those who have achieved at the college level, regardless of where or how, to demonstrate their competence and to have this competence recognized and become the basis for awarding credit toward a degree.

Students interested in taking departmental examinations must request an interview at which time they must present evidence to show that they do possess sufficient competency to be given permission to take a departmental examination. When permission is given to a student to take a departmental examination the conditions of the examination will be set forth. A $25.00 examination fee must be paid prior to taking the examination.

BACHELOR OF SCIENCE

ACCOUNTING

Required Courses—Arts and Sciences
48 credits (each subject—3 credits)

*42.101	College Writing
*42.102	College Writing and Literature
*42.111	Technical and Business Writing
*47.101	General Psychology
48.101	Introduction to Sociology
*90.112	Mathematics B
*90.119	Mathematics C
*90.241	Statistics for Business I
*90.242	Statistics for Business II
*90.251	Computers I
*90.252	Computers II
*68.201	Economics I
*68.202	Economics II
68.307	Government and Business
68.312	Managerial Economics
68.332	Money and Banking

Required Courses—Business
30 credits (each subject—3 credits)

*67.201	Accounting Principles I
*67.202	Accounting Principles II
67.301	Intermediate Accounting I
67.302	Intermediate Accounting II
67.401	Advanced Financial Accounting I
*67.411	Cost Accounting I
*69.331	Business Finance
*69.371	Operations Management I
*69.201	Principles of Management
69.498	Business Policy I

ELECTIVES

Behavioral and Social Science Electives (Area I)	— 6 credits
Fine Arts and Humanities Electives (Area II)	— 6 credits
Science Electives	— 6 credits
Free Electives	— 30 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—72 credits

Required courses—Arts and Sciences	— 36 credits (as asterisked)
Required courses—Business	— 18 credits (as asterisked)
Area I and/or Area II Electives	— 6 credits
Free Electives	— 12 credits

SUGGESTED SEQUENCE FOR ASSOCIATE OF SCIENCE DEGREE

ACCOUNTING

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
68.201	Economics I	3	68.202	Economics II	3
42.101	College Writing	3	42.102	College Writing & Literature	3
		9			9

SECOND YEAR

69.201	Principles of Management	3	69.331	Business Finance	3
42.111	Technical and Business Writing	3	......	Area I or II Elective	3
90.112	Mathematics B	3	90.119	Mathematics C	3
		9			9

THIRD YEAR

90.241	Statistics for Business I	3	90.242	Statistics for Business II	3
......	Elective	3	69.371	Operations Management I	3
67.411	Cost Accounting I	3	......	Elective	3
		9			9

FOURTH YEAR

90.251	Computers I	3	90.252	Computers II	3
......	Elective	3	......	Elective	3
......	Area I or II Elective	3	47.101	General Psychology	3
		9			9

All students in this program should contact the Evening School for guidance in selection of electives

BACHELOR OF SCIENCE

BANKING

Required Courses—Arts and Sciences
48 credits (each subject—3 credits)

*42.101	College Writing
*42.102	College Writing and Literature
*42.111	Technical and Business Writing
47.101	General Psychology
48.101	Introduction to Sociology
*90.112	Mathematics B
*90.119	Mathematics C
*90.251	Computers I
*90.252	Computers II
*68.201	Economics I
*68.202	Economics II
*90.241	Statistics for Business I
*90.242	Statistics for Business II
*68.312	Managerial Economics
68.307	Government and Business
68.332	Money and Banking

Required Courses—Business
30 credits (each subject—3 credits)

*67.201	Accounting Principles I
*67.202	Accounting Principles II
*67.362	Business Law I
*69.101	Principles of Bank Operations
	or
*69.110	Savings and Time Deposit Banking
*69.103	Credit Administration
*69.331	Business Finance
69.451	Personnel Management
69.106	Home Mortgage Lending
69.107	Bank Investments
69.498	Business Policy I

ELECTIVES

Behavioral and Social Science Electives (Area I)	— 6 credits
Fine Arts and Humanities Electives (Area II)	— 6 credits
Science Electives	— 6 credits
Free Electives	— 30 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—72 credits

Required courses—Arts and Sciences	— 36 credits (as asterisked)
Required courses—Business	— 18 credits (as asterisked)
Area I and/or Area II Electives	— 6 credits
Free Electives	— 12 credits

SUGGESTED SEQUENCE FOR ASSOCIATE OF SCIENCE DEGREE

BANKING

FIRST YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
42.101	College Writing	3	42.102	College Writing & Literature	3
69.101	Principles of Bank Operations		69.103	Credit Administration	3
	or				
69.110	Savings & Time Deposit Banking	3			
		9			9

SECOND YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
68.201	Economics I	3	68.202	Economics II	3
90.112	Mathematics B	3	90.119	Mathematics C	3
67.362	Business Law I	3	69.331	Business Finance	3
		9			9

THIRD YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
90.241	Statistics for Business I	3	90.242	Statistics for Business II	3
68.332	Money and Banking	3	42.111	Technical and Business Writing	3
......	Elective	3	......	Elective	3
		9			9

FOURTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
......	Elective	3	......	Elective	3
......	Area I or II Elective	3	......	Area I or II Elective	3
90.251	Computers I	3	90.252	Computers II	3
		9			9

All students in ths program should contact the Evening School for guidance in selection of electives.

BACHELOR OF SCIENCE

INFORMATION SYSTEMS

Required Courses—Arts and Sciences
42 credits (each subject—3 credits)

*42.101	College Writing
*42.102	College Writing and Literature
*42.111	Technical and Business Writing
47.101	General Psychology
48.101	Introduction to Sociology
*90.112	Mathematics B
*90.119	Mathematics C
*68.201	Economics I
*68.202	Economics II
*90.241	Statistics for Business I
*90.242	Statistics for Business II
68.307	Government and Business
68.332	Money and Banking
68.312	Managerial Economics

Required Courses—Business
30 credits (each subject—3 credits)

*67.201	Accounting Principles I
*67.202	Accounting Principles II
*67.311	Managerial Accounting
*69.331	Business Finance
*69.201	Principles of Management
*69.371	Operations Management I
69.321	Marketing Principles
69.498	Business Policy I
69.463	Management Information Systems I
69.464	Management Information Systems II

Required Courses—Computer Science
18 credits (each subject—3 credits)

*92.363	Introduction to Computers
*90.361	Fortran Programming
*92.365	Cobol Programming I
*92.368	Cobol Programming II
*92.367	Assembler Language Programming I
*92.462	Advanced Programming Systems

ELECTIVES

Behavioral and Social Science Electives (Area I)	— 6 credits
Fine Arts and Humanities Electives (Area II)	— 6 credits
Science Electives	— 6 credits
Free Electives	— 18 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—72 CREDITS

Required Courses—Arts and Sciences	— 27 credits (as asterisked)
Required Courses—Business	— 18 credits (as asterisked)
Required Courses—Computer Science	— 18 credits (as asterisked)
Area I and/or Area II Electives	— 3 credits
Free Electives	— 6 credits

SUGGESTED SEQUENCE FOR ASSOCIATE OF SCIENCE DEGREE

INFORMATION SYSTEMS

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
92.363	Introduction to Computers	3	90.361	Fortran Programming	3
90.112	Mathematics B	3	90.119	Mathematics C	3
42.101	College Writing	3	42.102	College Writing & Literature	3
		9			9

SECOND YEAR

67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
42.111	Technical and Business Writing	3	69.201	Principles of Management	3
92.365	Cobol Programming I	3	92.368	Cobol Programming II	3
		9			9

THIRD YEAR

92.367	Assembler Language Prog. I	3	92.462	Advanced Programming Systems	3
67.311	Managerial Accounting	3	69.331	Business Finance	3
68.201	Economics I	3	68.202	Economics II	3
		9			9

FOURTH YEAR

90.241	Statistics for Business I	3	90.242	Statistics for Business II	3
......	Area I or II Elective	3	69.371	Operations Management I	3
......	Elective	3	......	Elective	3
		9			9

All students in this program should contact the Evening School for guidance in selection of electives.

BACHELOR OF SCIENCE

MANAGEMENT

Required Courses—Arts and Sciences
48 credits (each subject—3 credits)

*42.101 College Writing
*42.102 College Writing and Literature
*42.111 Technical and Business Writing
*47.101 General Psychology
48.101 Introduction to Sociology
*90.112 Mathematics B
*90.119 Mathematics C
*90.251 Computers I
*90.252 Computers II
*68.201 Economics I
*68.202 Economics II
*90.241 Statistics for Business I
*90.242 Statistics for Business II
68.307 Government and Business
68.332 Money and Banking
68.312 Managerial Economics

Required Courses—Business
30 credits (each subject—3 credits)

*67.201 Accounting Principles I
*67.202 Accounting Principles II
*67.311 Managerial Accounting
67.362 Business Law I
*69.201 Principles of Management
*69.331 Business Finance
69.321 Marketing Principles
69.451 Personnel Management
*69.371 Operations Management I
69.498 Business Policy I

ELECTIVES

Behavioral and Social Science Electives (Area I)	— 6 credits
Fine Arts and Humanities Electives (Area II)	— 6 credits
Science Electives	— 6 credits
Free Electives	— 30 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—72 credits

Required courses—Arts and Sciences	— 36 credits (as asterisked)
Required courses—Business	— 18 credits (as asterisked)
Area I and/or Area II Electives	— 6 credits
Free Electives	— 12 credits

SUGGESTED SEQUENCE FOR ASSOCIATE OF SCIENCE DEGREE

MANAGEMENT

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
68.201	Economics I	3	68.202	Economics II	3
42.101	College Writing	3	42.102	College Writing & Literature	3
		9			9

SECOND YEAR

69.201	Principles of Management	3	67.311	Managerial Accounting	3
42.111	Technical and Business Writing	3	90.119	Mathematics C	3
90.112	Mathematics B	3	......	Area I or II Elective	3
		9			9

THIRD YEAR

90.241	Statistics for Business I	3	90.242	Statistics for Business II	3
69.371	Operations Management I	3	69.331	Business Finance	3
......	Elective	3	......	Elective	3
		9			9

FOURTH YEAR

90.251	Computers I	3	90.252	Computers II	3
......	Elective	3	......	Elective	3
......	Area I or II Elective	3	47.101	General Psychology	3
		9			9

All students in this program should contact the Evening School for guidance in selection of elective.

BACHELOR OF SCIENCE

PUBLIC SERVICE-POLICE SCIENCE

General Institute Requirements

45 credits (each subject—3 credits)

67.201	Accounting Principles I
90.241	Statistics for Business I
*42.111	Technical and Business Writing
68.201	Economics I
68.202	Economics II
*94.341	Fundamentals of Science I
*94.342	Fundamentals of Science II
*90.111	Mathematics A
*90.112	Mathematics B
*42.101	College Writing
*42.102	College Writing and Literature
*48.101	Introduction to Sociology
*47.101	General Psychology
54.101	Beginning Spanish I
54.102	Beginning Spanish II

Criminal Justice Requirements

36 credits (each subject—3 credits)

*44.101	The Criminal Justice System
*44.221	Criminology I
44.222	Criminology II
*44.131	Principles of Law and Legal System
*44.141	Police Functions
44.253	Problems of Misdemeanants
44.241	Comparative Police Systems
44.243	Criminalistics I
44.244	Criminalistics II
44.161	Juvenile Delinquency
*46.195	Constitutional Law I
*46.196	Constitutional Law II
44.371	Criminal Justice Mgmt. and Planning
44.234	Criminal Law
44.496	Practicum-Field Experience I
44.490	Criminal Justice Research Seminar
44.401	Seminar on Drugs
44.390	Introduction to Criminal Justice Research
44.373	Issues in Police Administration

ELECTIVES

Behaviorial and Social Science Electives (Area I)	— 24 credits
Fine Arts and Humanities Electives (Area II)	— 9 credits
Free Electives	— 12 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—63 credits

General Institute Requirements	— 27 credits (as asterisked)
Criminal Justice Requirements	— 18 credits (as asterisked)
Area I —Electives	— 9 credits
Area II—Electives	— 6 credits
Free Electives	— 3 credits

SUGGESTED SEQUENCE FOR FIRST TWO YEARS

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
44.101	The Criminal Justice System	3	44.221	Criminology I	3
42.101	College Writing	3	42.102	College Writing and Literature	3
48.101	Intro. to Sociology	3	47.101	General Psychology	3
		9			9

SECOND YEAR

44.131	Princ. of Law & Legal System	3	44.141	Police Functions	3
90.111	Mathematics	3	90.112	Mathematics B	3
......	Area I or II Elective	3	......	Area I or II Elective	3
		9			9

BACHELOR OF SCIENCE

PUBLIC SERVICE—CORRECTIONS ADMINISTRATION

General Institute Requirements
45 credits (each subject—3 credits)

67.201	Accounting Principles I
90.241	Statistics for Business I
*42.111	Technical and Business Writing
62.201	Economics I
62.202	Economics II
*94.341	Fundamentals of Science I
*94.342	Fundamentals of Science II
*90.111	Mathematics A
*90.112	Mathematics B
*42.101	College Writing
*42.102	College Writing and Literature
*48.101	Introduction to Sociology
*47.101	General Psychology
54.101	Beginning Spanish I
54.102	Beginning Spanish II

Criminal Justice Requirements
36 credits (each subject—3 credits)

*44.101	The Criminal Justice System
*44.221	Criminology I
44.222	Criminology II
*44.131	Principles of Law and Legal System
*44.151	Introduction to Corrections I
*44.152	Introduction to Corrections II
44.251	Alternatives to Corrections I
44.252	Alternatives to Corrections II
44.253	Problems of Misdemeanants
44.372	Issues in Correctional Administration
*44.161	Juvenile Delinquency
44.231	Juvenile Court Philosophy & Practice
44.254	Probation and Parole I
44.255	Probation and Parole II
44.371	Criminal Justice Management & Planning
44.331	Penal Law
44.235	Youth and the Law
44.490	Criminal Justice Research Seminar
44.496	Practicum-Field Experience I
44.401	Seminar in Drugs
44.390	Introduction to Criminal Justice Research

ELECTIVES

Behavioral and Social Science Electives (Area I)	— 24 credits
Fine Arts and Humanities Electives (Area II)	— 9 credits
Free Electives	— 12 credits

ASSOCIATE OF SCIENCE DEGREE REQUIREMENTS—63 credits

General Institute Requirements	— 27 credits (as asterisked)
Criminal Justice Requirements	— 18 credits (as asterisked)
Area I —Electives	— 9 credits
Area II—Electives	— 6 credits
Free Electives	— 3 credits

SUGGESTED SUBJECTS FOR FIRST TWO YEARS

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
44.101	The Criminal Justice System	3	44.221	Criminology I	3
42.101	College Writing	3	42.102	College Writing and Literature	3
48.101	Intro to Sociology	3	47.101	General Psychology	3
		9			9

SECOND YEAR

44.131	Princ. of Law & Legal Systems	3	44.161	Juvenile Delinquency	3
90.111	Mathematics	3	90.112	Mathematics B	3
......	Area I or II Elective	3	......	Area I or II Elective	3
		9			9

BACHELOR OF SCIENCE

APPLIED CHEMISTRY

Years 1-4—Leading to the Degree of Associate of Science

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
84.121	Chemistry	3	84.126	Chemistry	3
90.113	Intro. to Analysis I	3	90.115	Intro. to Analysis II	3
42.101	College Writing	3	95.141	Physics I	3
		9			9

SECOND YEAR

86.121	Analytical Chemistry	3	86.122	Analytical Chemistry	3
90.131	Calculus I	3	90.132	Calculus II	3
99.142	Physics II	3	99.143	Physics III	3
		9			9

THIRD YEAR

84.223	Organic Chemistry I B	3	84.224	Organic Chemistry II B	3
86.231	Organic Chemistry Lab I	3	86.232	Organic Chemistry Lab II	3
17.127	Electrical Fundamentals	3	42.102	College Writing and Literature	3
		9			9

FOURTH YEAR

86.341	Intro. to Physical Chemistry	3	86.342	Intro. to Physical Chemistry	3
84.337	Princ. of Physical Chem. Lab.	3	84.338	Princ. of Physical Chem. Lab.	3
......	Elective	3	......	Elective	3
		9			9

All electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

APPLIED CHEMISTRY

Years 5-8—Leading to the Degree of Bachelor of Science

FIFTH YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credit	Subject No.		Credit
84.334	Advanced Inorganic Chemistry	3	86.352	Chemical Applications	3
92.383	Intro. to Statistics	3	90.361	Fortran Programming	3
42.112	Technical & Scientific Writing	3	......	Area II Elective	3
		9			9

SIXTH YEAR

86.361	Advanced Organic Chemistry	3	86.362	Advanced Organic Chemistry	3
27.201	Plastics Materials Science	3	69.201	Principles of Management	3
......	Area I Elective	3	23.352	Properties of Materials	3
		9			9

SEVENTH YEAR

86.471	Industrial Chemistry	3	84.314	Analytical Chemistry II	3
68.201	Economics I	3	84.316	Analytical Chemistry II Lab	3
......	Area I or II Elective	3	68.202	Economics II	3
		9			9

EIGHTH YEAR

86.481	Chemistry of High Polymers	3	86.482	Chemistry of High Polymers	3
......	Elective	3	......	Elective	3
......	Elective	3	......	Elective	3
		9			9

All electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

BACHELOR OF SCIENCE

APPLIED MATHEMATICS-SCIENTIFIC DATA PROCESSING OPTION

Years 1-4—Leading to the Degree of Associate of Science

FIRST YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
92.363	Intro. to Computers	3	92.367	Assembler Language Prog. I	3
90.113	Intro. to Analysis I	3	90.115	Intro. To Analysis II	3
42.101	College Writing	3	42.102	College Writing and Literature	3
		9			9

SECOND YEAR

68.201	Economics I	3	68.202	Economics II	3
90.361	Fortran Programming	3	92.366	Advanced Fortran Programming	3
90.131	Calculus I	3	90.231	Calculus II	3
		9			9

THIRD YEAR

92.463	Systems Design & Dev. I	3	92.464	Systems Design & Dev. II	3
90.231	Calculus III	3	90.232	Calculus IV	3
92.383	Intro. to Statistics	3	95.141	Physics I	3
		9			9

FOURTH YEAR

92.461	Systems Simulation & Modeling	3	92.462	Advanced Programming Systems	3
99.142	Physics II	3	99.143	Physics III	3
......	Area I or II Elective	3	42.112	Technical & Scientific Writing	3
		9			9

APPLIED MATHEMATICS-SCIENTIFIC DATA PROCESSING OPTION

Years 5-8—Leading to the Degree of Bachelor of Science

FIFTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
92.314	Differential Equations	3	90.315	Partial Differential Equations	3
......	Area I Elective	3	......	Area II Elective	3
*.....	Technical Elective	3	*.....	Technical Elective	3
		9			9

SIXTH YEAR

92.362	Methods in Numerical Analysis I	3	90.454	Methods in Numerical Analysis II	3
92.301	Applied Mathematics I	3	92.302	Applied Mathematics II	3
**.....	Technical Elective	3	**....	Technical Elective	3
		9			9

SEVENTH YEAR

92.467	Assembler Language Prog. II	3	92.469	Compiler Construction Tech.	3
......	Mathematics Elective	3	......	Mathematics Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

EIGHTH YEAR

92.470	Remote Computing	3	92.471	Managing the DP Function	3
92.411	Complex Variables I	3	......	Mathematics Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

*Those holding an Associate in Science (Mathematics) must take 92.367 and 92.462.

Those holding an Associate in Science (Scientific Data Processing) must take 92.221 and 92.222.

**Those holding an Associate in Science (Mathematics) must take 92.463 and 92.464.

Those holding an Associate in Science (Scientific Data Processing) must take 84.121 and 84.126.

All Technical Electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

BACHELOR OF SCIENCE

APPLIED MATHEMATICS

Years 1-4—Leading to the Degree of Associate of Science

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
68.201	Economics I	3	68.202	Economics II	3
90.113	Intro. to Analysis I	3	90.115	Intro. to Analysis II	3
42.101	College Writing	3	95.141	Physics I	3
		9			9

SECOND YEAR

92.363	Intro. to Computers	3	90.361	Fortran Programming	3
90.131	Calculus I	3	90.132	Calculus II	3
99.142	Physics II	3	99.143	Physics III	3
		9			9

THIRD YEAR

90.231	Calculus III	3	90.232	Calculus IV	3
92.383	Intro. to Statistics	3	42.112	Technical & Scientific Writing	3
42.102	College Writing and Literature	3	......	Elective	3
		9			9

FOURTH YEAR

84.121	Chemistry	3	84.126	Chemistry	3
92.461	Systems Simulation & Modeling	3	90.222	Applied Linear Algebra II	3
90.221	Applied Linear Algebra I	3	......	Area I or II Elective	3
		9			9

APPLIED MATHEMATICS

Years 5-8—Leading to the Degree of Bachelor of Science

FIFTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
92.314	Differential Equations	3	90.315	Partial Differential Equations	3
......	Area I Elective	3	......	Area II Elective	3
*.....	Technical Elective	3	*.....	Technical Elective	3
		9			9

SIXTH YEAR

Subject No.	First Semester	Credits	Subject No.	Second Semester	Credits
92.362	Methods in Numerical Analysis I	3	90.454	Methods in Numercial Analysis II	3
92.301	Applied Mathematics I	3	92.302	Applied Mathematics II	3
**+....	Technical Elective	3	**+...	Technical Elective	3
		9			9

SEVENTH YEAR

Subject No.	First Semester	Credits	Subject No.	Second Semester	Credits
+92.467	Assembler Language Prog. II.	3	+92.469	Compiler Construction Tech.	3
......	Mathematics Elective	3	......	Mathematics Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

EIGHTH YEAR

Subject No.	First Semester	Credits	Subject No.	Second Semester	Credits
+92.470	Remote Computing	3	+92.471	Managing the DP Function	3
92.411	Complex Variable I	3	......	Mathematics Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

*Those holding an Associate in Science (Mathematics) must take 92.367 and 92.462
Those holding an Associate in Science (Scientific Data Processing) must take 92.221 and 92.222

**Those holding an Associate in Science (Mathematics) must take 92.463 and 92.464
Those holding an Associate in Science (Scientific Data Processing) must take 84.121 and 84.126

+The above courses may be replaced by a sequence of related courses approved by the Program Coordinator.

All other electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

BACHELOR OF SCIENCE

MEDICAL TECHNOLOGY

[ASCP Certification (C.L.A. or M.L.T.) is required for admission to the Medical Technology Program]

Years 1-4—Leading to evaluation for continuation in Medical Technology curriculum

FIRST YEARS

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
42.101	College Writing	3	42.102	College Writing & Literature	3
35.101	Anatomy & Physiology I	3	35.102	Anatomy & Physiology II	3
35.103	Anatomy & Physiology I Lab.	1	35.104	Anatomy & Physiology II Lab.	1
		7			7

SECOND YEAR

35.251	Physiological Sciences I	3	35.252	Physiological Sciences II	3
35.253	Physiological Sciences I Lab.	1	35.254	Physiological Sciences II Lab.	1
......	Psychology Elective	3	90.115	Intro. to Analysis II	3
		7			7

THIRD YEAR

35.211	Basic Clinical Microbiology & Pathology	3	92.209	Intro. to Theory Comp. Prog.	3
35.213	Basic Clinical Microbiology & Pathology Lab.	1	......	Area II Elective	3
92.206	Elementary Statistical Analysis	3	......	General Elective	3
		7			9

FOURTH YEAR

......	Literature Elective	3	......	General Elective	3
......	Sociology Elective	3	36.341	Fund. of Clinical Chemistry	3
30.202	Community Health	3	36.342	Fund. of Clinical Chem. Lab.	2
		9			8

BACHELOR OF SCIENCE

MEDICAL TECHNOLOGY

Years 5-7—Leading to Degree of Bachelor of Science in Medical Technology

FIFTH YEAR

Subject No.		Credits	Subject No.		Credits
......	General Elective	3	36.350	Human Biochemistry	3
36.361	Medical Instrumentation	3	36.321	Clinical Hematology	2
36.363	Medical Instrumentation Lab I.	2	*36.323	Clinical Hematology Lab	2
		8			7

SIXTH YEAR

36.351	Clinical Biochemistry I	3	36.452	Clinical Biochemistry II	3
*36.353	Clinical Biochemistry I Lab	2	36.454	Clinical Biochemistry II Lab	2
36.335	Medical & Clinical Genetics	2	......	Free Elective	3
36.337	Medical & Clinical Genetics Lab	1			
		8			8

SEVENTH YEAR

36.311	Clinical Microbiology	3	36.331	Immunology	½
*36.313	Clinical Microbiology Lab	2	36.333	Immunology Lab	½
36.461	Automation	2	36.332	Immunohematology	1
			*36.334	Immunohematology Lab	1
			36...	Medical Technology Elective	3
			36.472	Medical Technology Seminar	3
		7			9

Practicum—16 Semester hours**

36.420 Clinical Hematology Practicum
36.410 Clinical Microbiology Practicum
36.450 Clinical Biochemistry Practicum
36.430 Clinical Immunohematology Practicum

*The Department of Clinical Laboratory Sciences recognizes that experienced gained on the job may be equivalent and provides the student the opportunity to gain credits through equivalency examination in these areas.

**Students with ASCP Certification (as Clinical Laboratory Assistants and/or Medical Laboratory Technicians); a minimum of one year clinical experience; and a minimum of a two month clinical rotation in each of the following areas (Clinical Hematology, Clinical Chemistry, Blood Bank—Serology, Clinical Microbiology) will be execused from the clinical practicum.

General Electives must be selected with permission of program coordinator.

BACHELOR OF SCIENCE

NURSING

Years 1-4—Leading to evaluation for continuation in Nursing Program

FIRST YEAR

First Semester (Sept.) Subject No.		Credits	Second Semester (Jan.) Subject No.		Credits
42.101	College Writing	3	42.102	College Writing and Literature	3
35.101	Anatomy and Physiology I	3	35.102	Anatomy & Physiology II	3
35.103	Anatomy & Physiology Lab I	1	35.104	Anatomy & Physiology Lab II	1
		7			7

SECOND YEAR

47.101	General Psychology	3	......	Sociology Elective or Social Anthropology	3
35.251	Physiological Science I	3	35.252	Physiological Science II	3
35.253	Physiological Science Lab I	1	35.254	Physiological Science Lab II	1
		7			7

THIRD YEAR

92.209	Intro. to Theory of Comp. Prog.	3	92.206	Elementary Statistical Analysis	3
35.211	Basic Clinical Microbiology & Pathology	3	47.163	Developmental Psychology	3
35.213	Basic Clinical Microbiology & Pathology Lab	1	47.232	Theories of Personality	3
		7			9

FOURTH YEAR

......	30.202 Community Health	3		Area II Elective	3
......	Literature Elective	3	......	Elective	3
......	Elective	3	......	Pathology	3
		9			9

NOTE: This program is open only to Registered Nurses

NURSING

Years 5-6—Leading to the Degree of Bachelor of Science

FIFTH YEAR

First Semester (Sept.) Subject No.		Credits	Second Semester (Jan.) Subject No.		Credits
33.301A	Nursing Science I—Lecture and Psychosocial Assessment.	3	33.301B	Nursing Science I—Lecture and Psychosocial Assessment.	2
33.302	Nursing Science I—Basic Clinical Module	3	33.303	Nursing Science I—Maternal/Child Health and Clinical Module	3
33.305	Nursing Science I—History/Physical Assessment Lab	1	33.307	Nursing Science Seminar	1
				Elective (300-400 Level)	3
33.306	Nursing Science I—History/Physical Assessment Lab	1			
		8			9

SIXTH YEAR

33.406A	Nursing Science IV—Lecture	2.0	33.406B	Nursing Science IV—Lecture	3
33.408	Nursing Science IV—A.V. Simulation Lab	0.5	33.407	Nursing Science IV—Seminar	1
33.409A	Nursing Science IV—Clinical Hosp. Lab: Internal Rotat.	1.5	33.409B	Nursing Science IV—Clinical Hosp. Lab: Internal Rotation	1.5.
33.410A	Nursing Science IV—Community Laboratory	1.5	33.410B	Nursing Science IV—Community Laboratory	1.5
33.411	Nursing Science IV— Clinical History/Physical Exam & Practicum	0.5			
.....	Elective (300-400 Level)	3.0			
		9.0			6.0

NOTE: The sixth year will also be offered in a ten week summer day session.

Students must pass course equivalency examinations in the following subjects in order to be admitted to the final year of the program.

Subjects	Credits
33.202 Basic Principles for Nursing Practice	3
33.309 Nursing Science II—Lecture	4
33.310 Nurisng Science II—Medical/Surgical/Psychiatric Nursing Clinical Module	3
33.311 Nursing Science II—Maternal Child Health/Community Clinical Module	3
33.312 Nursing Science II—Psychosocial Assessment	1
33.313 Nursing Science II—History/Physical Assessment Lecture	1
33.314 Nursing Science II—History/Physical Assessment Lab	1
33.315 Nursing Science II—Seminar	1
33.401 Nursing Science III—Lecture	5
33.402 Nursing Science III—Seminar	1
33.403 Nursing Science III—Clinical Hospital Laboratory	3
33.404 Nursing Science III—Community Laboratory	3
33.405 Nursing Science III—Clinical History/Physical Exam Recitation	1
	30

BACHELOR OF SCIENCE IN ENGINEERING TECHNOLOGY

CIVIL ENGINEERING TECHNOLOGY

Years 1-4—Leading to the Degree of Associate of Science in Engineering Technology

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
90.113	Intro to Analysis I	3	90.115	Intro. to Analysis II	3
23.111	Engineering Drawing I	3	23.112	Engineering Drawing II	3
42.101	College Writing	3	42.102	College Writing and Literature	3
		9			9

SECOND YEAR

15.123	Surveying I	3	15.124	Surveying II	3
90.131	Calculus I	3	90.132	Calculus II	3
45.141	Physics I	3	99.142	Physics II	3
		9			9

THIRD YEAR

15.237	Statics	3	15.239	Strength of Materials (CE)	3
15.255	Environmental Engineering I	3	15.243	Construction Materials	3
15.257	Highway Elements	3	42.112	Technical & Scientific Writing	3
		9			9

FOURTH YEAR

15.251	Structural Analysis I	3	15.242	Steel Design I	3
15.253	Concrete Analysis & Design I	3	15.246	Intro. to Hydraulics	3
15.238	Dynamics (CE)	3	15.254	Soil Mechanics I	3
		9			9

CIVIL ENGINEERING TECHNOLOGY

Years 5-8—Leading to the Degree of Bachelor of Science in Engineering Technology

FIFTH YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
15.352	Structural Analysis II	3	15.356	Environmental Engineering II	3
15.391	Concrete Analysis & Design II	3	15.383	Steel Design II	3
84.121	Chemistry	3	84.126	Chemistry	3
		9			9

SIXTH YEAR

15.392	Soil Mechanics II	3	15.394	Soil Mechanics Lab	3
90.361	Fortran Programming	3	....	Area II Elective	3
90.231	Calculus III	3	90.232	Calculus IV	3
		9			9

SEVENTH YEAR

68.201	Economics I	3	68.202	Economics II	3
17.127	Electrical Fundamentals	3	99.143	Physics III	3
......	Area I Elective	3	......	Technical Elective	3
		9			9

EIGHTH YEAR

15.461	Advanced Surveying	3	15.486	Transportation Elements	3
20.414	Industrial Economics Mgt.	3	......	Area I or II Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

Technical Electives may be selected from the Engineering Technology, Science, and Math areas.

Technical Electives from other areas must be approved by the Program Coordinator.

BACHELOR OF SCIENCE IN ENGINEERING TECHNOLOGY

ELECTRONIC ENGINEERING TECHNOLOGY

Years 1-4—Leading to the Degree of Associate of Science in Engineering Technology

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
90.113	Intro. to Analysis I	3	90.115	Intro. to Analysis II	3
90.361	Fortran Programming	3	95.141	Physics I	3
42.101	College Writing	3	42.102	College Writing and Literature	3
		9			9

SECOND YEAR

17.223	Electric Circuits I	3	17.224	Electric Circuits II	3
90.131	Calculus I	3	90.132	Calculus II	3
99.142	Physics II	3	42.112	Technical & Scientific Writing	3
		9			9

THIRD YEAR

17.225	Electric Circuits III	3	17.240	Electromechanics	3
17.237	Electronics Lab	3	17.362	Electronics I	3
90.231	Calculus III	3	90.232	Calculus IV	3
		9			9

FOURTH YEAR

17.241	Energy Conversion	3	17.350	Control Systems I	3
17.363	Electronics II	3	17.364	Electronics III	3
17.359	Electronics Lab	3	17.360	Electronics Lab	3
		9			9

Students enrolling in this program should purchase an electronic calculator capable of handling logarithmic and trigonometric functions. The use of the calculator will be an integral part of courses 17.223 and 17.224 where proficiency will be developed. Competency in the use of the calculator will be assumed in all subsequent EE courses.

Students terminating with the Associate in Engineering Technology Degree may replace 90.231 and 90.232 with approved technical electives.

All electives shall be chosen after conference with the Program Coordinator and MUST be approved by him. If electives are not properly approved, it is possible they will not be credited toward the degree requirement.

ELECTRONIC ENGINEERING TECHNOLOGY

Years 5-8—Leading to the Degree of Bachelor of Science in Engineering Technology

FIFTH YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
17.361	Electronics Lab.	3	84.121	Chemistry	3
17.371	Logic Design I.	3	17.372	Logic Design II.	3
92.314	Differential Equations.	3	17.376	Electromagnetic Theory	3
		9			9

SIXTH YEAR

17.365	Integrated Circuits I.	3	17.366	Integrated Circuits II.	3
17.381	Engineering Prob. Sol. I.	3	17.382	Engineering Prob. Sol. II.	3
......	Area I Elective	3	......	Area II Elective	3
		9			9

SEVENTH YEAR

......	E.E.T. Elective	3	......	E.E.T. Elective	3
99.143	Physics III.	3	23.455	Thermo & Heat Transfer	3
......	Technical Elective	3	......	Area I or II Elective	3
		9			9

EIGHTH YEAR

68.201	Economics I.	3	68.202	Economics II.	3
17.391	Project Laboratory I.	3	17.392	Project Laboratory II.	3
......	E.E.T. Elective	3	......	E.E.T. Elective	3
		9			9

All other electives shall be chosen after conference with the Program Coodinator and MUST be approved by him.

If electives are not properly approved, it is possible they will not be credited toward the degree requirement.

BACHELOR OF SCIENCE IN ENGINEERING TECHNOLOGY

INDUSTRIAL ENGINEERING TECHNOLOGY

Years 1-4—Leading to the Degree of Associate of Science in Engineering Technology

This program is being phased out. No beginning students will be accepted starting September, 1977.

SECOND YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
90.131	Calculus I	3	69.201	Principles of Management	3
95.141	Physics I	3	90.132	Calculus II	3
42.112	Technical & Scientific Writing	3	99.142	Physics II	3
		9			9

THIRD YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
20.351	Method Time Analysis	3	21.254	Plant Layout & Materials Handling	3
99.143	Physics III	3	23.201	Mech. Tech. Lab I	3
23.221	Applied Mechanics (Statics)	3	23.223	Strength of Materials	3
		9			9

FOURTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
92.383	Intro. to Statistics	3	20.476	Statistical Quality Control	3
......	Area I or II Elective	3	21.256	Production Measurements	3
......	Technical Elective Technical Elective		......	3	
		9			9

All electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

INDUSTRIAL ENGINEERING TECHNOLOGY

Years 5-8—Leading to the Degree of Bachelor of Science in Engineering Technology

FIFTH YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
84.121	Chemistry	3	21.382	Mfg. Cost Analysis	3
17.127	Electrical Fundamentals	3	90.231	Calculus III	3
21.361	Cost Control Systems	3	......	Technical Elective	3
		9			9

SIXTH YEAR

68.201	Economics I	3	68.202	Economics II	3
21.353	Industrial Instrumentation	3	21.372	Operations Research	3
21.381	Organization Design & Control	3	21.374	Production Management	3
		9			9

SEVENTH YEAR

......	I.E.T. Elective	3	23.352	Properties of Materials I	3
......	Area II Elective	3	47.101	General Psychology	3
......	Technical Elective	3	......	I.E.T. Elective	3
		9			9

EIGHTH YEAR

20.414	Industrial Economic Mgt.	3	21.492	Production Analysis	3
......	I.E.T. Elective	3	......	I.E.T. Elective	3
......	Area I or II	3	......	Technical Elective	3
		9			9

All electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

BACHELOR OF SCIENCE IN ENGINEERING TECHNOLOGY

MECHANICAL ENGINEERING TECHNOLOGY

Years 1-4—Leading to the Degree of Associate of Science in Engineering Technology

FIRST YEAR

First Semester (Sept.) Subject No.		Credits	Second Semester (Jan.) Subject No.		Credits
90.113	Intro. to Analysis I	3	90.115	Introl to Analysis II	3
23.111	Engineering Drawing I	3	23.112	Engineering Drawing II	3
42.101	College Writing	3	95.141	Physics I	3
		9			9

SECOND YEAR

90.131	Calculus I	3	90.132	Calculus II	3
99.142	Physics II	3	99.143	Physics II	3
23.113	Machine Drawing	3	23.151	Engineering Tech. Comp.	3
		9			9

THIRD YEAR

23.231	Mechanisms	3	23.201	Mech. Tech. Lab I (Mach. Tool)	3
23.221	Applied Mechanics I (Statics)	3	23.222	Applied Mechanics II (Dynamics)	3
42.102	College Writing and Literature	3	23.223	Strenght of Materials	3
		9			9

FOURTH YEAR

23.241	Elements of Thermodynamics I	3	23.243	Elements of Thermodynamics II	3
23.242	Applied Fluid Mechanics	3	23.202	Mech. Tech. Lab II (Thermo-Fluids)	3
42.112	Technical & Scientific Writing	3	23.232	Machine Design	3
		9			9

Years 5-8—Leading to the Degree of Bachelor of Science in Engineering Technology

FIFTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
84.121	Chemistry	3	17.128	Basic Electronics	3
17.127	Electrical Fundamentals	3	90.232	Calculus IV	3
90.231	Calculus III	3	47.101	General Psychology	3
		9			9

SIXTH YEAR

92.314	Differential Equations	3	23.354	Problems in Mech. Eng. Technology	3
23.352	Properties of Materials I	3	23.303	Mechanical Technology Lab III (Materials)	3
23.353	Instrumentation Systems	3	......	Area II Elective	3
		9			9

SEVENTH YEAR

68.201	Economics I	3	68.202	Economics II	3
......	Area I or II	3	......	Free Elective	3
......	Free Elective	3	......	Technical Elective	3
		9			9

EIGHTH YEAR

20.414	Industrial Economic Mgt.		23.405	Mechanical Technology	
	Mechanical Technology	3		Lab V (Project)	3
23.404	Lab IV (Manufacturing)	3	......	Area I or II Elective	3
......	Technical Elective	3	......	Technical Elective	3
		9			9

All technical electives shall be chosen after conference with the Program Coordinator and MUST BE approved by him.

BACHELOR OF SCIENCE IN TECHNOLOGY

INDUSTRIAL TECHNOLOGY—MANUFACTURING OPTION

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
42.101	College Writing	3	42.102	College Writing & Literature	3
90.113	Intro. to Analysis I	3	90.115	Intro. to Analysis II	3
67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
		9			9

SECOND YEAR

20.107	Intro. to Engineering Design	3	23.201	Mech. Tech. Lab I (Machine Tool)	3
20.109	Engineering Design Lab	3	90.132	Calculus II	3
90.131	Calculus I	3	95.141	Physics I	3
		9			9

THIRD YEAR

23.221	Applied Mechnics I	3	23.223	Strength of Materials	3
90.361	Fortran Programming	3	84.121	Chemistry	3
92.383	Intro. to Statistics	3	84.123	Chemistry Laboratory	3
		9			9

FOURTH YEAR

20.201	Structure of Metals	3	20.301	Modern Materials	3
23.231	Mechanisms	3	20.476	Statistical Quality Control	3
92.365	Cobol Programming	3	42.112	Tech. & Sci. Communications	3
		9			9

INDUSTRIAL TECHNOLOGY—MANUFACTURING OPTION

FIFTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
27.201	Plastics Materials Science I	3	......	Area II Elective	3
20.307	Fluid Power Controls	3	69.321	Marketing Principles	3
69.371	Operations Management I	3	69.372 or 20.306	Operations Management II or Seminar I	3
		9			9

SIXTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
17.127	Electrical Fundamentals	3	20.408	Instrumentation & Proc. Control.	3
17.129	Electrical Fundamentals Lab.	3	20.410	Instrument. & Proc. Control Lab.	3
20.351	Method-Time Analysis	3	...... or 20.403	Technical Elective or Seminar II	3
		9			9

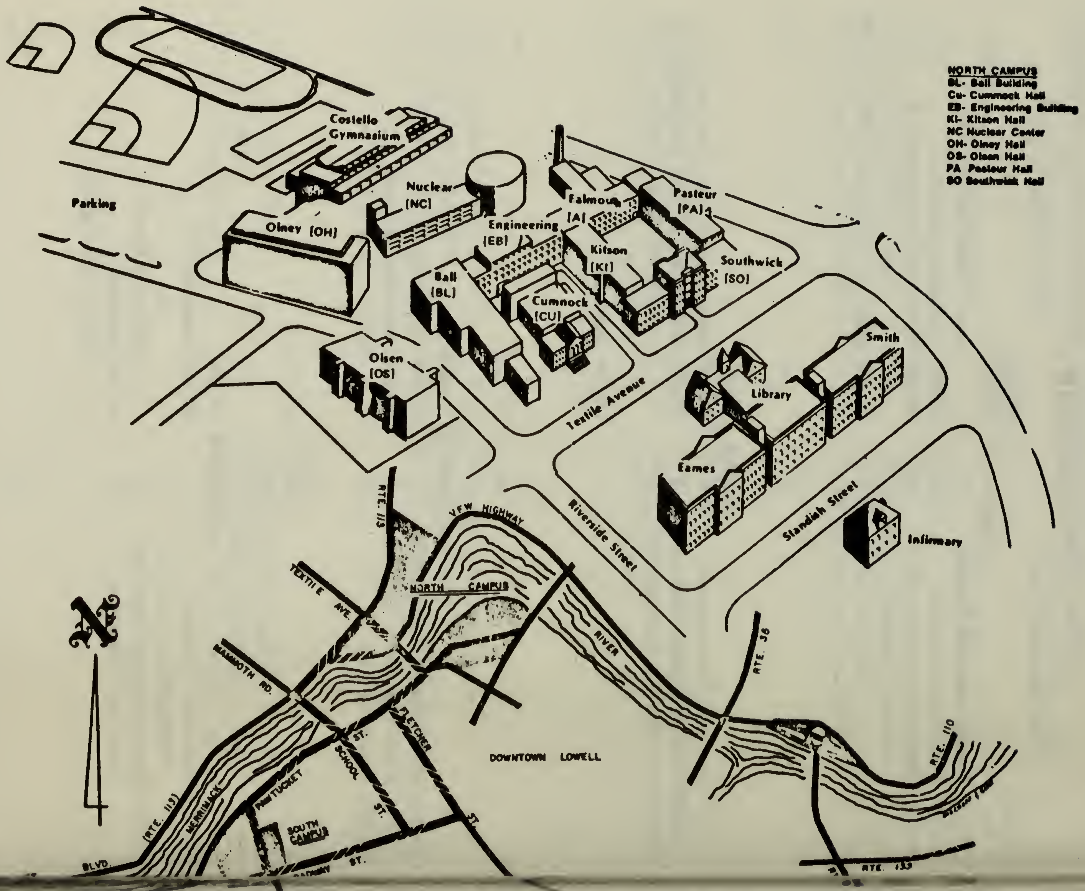
SEVENTH YEAR

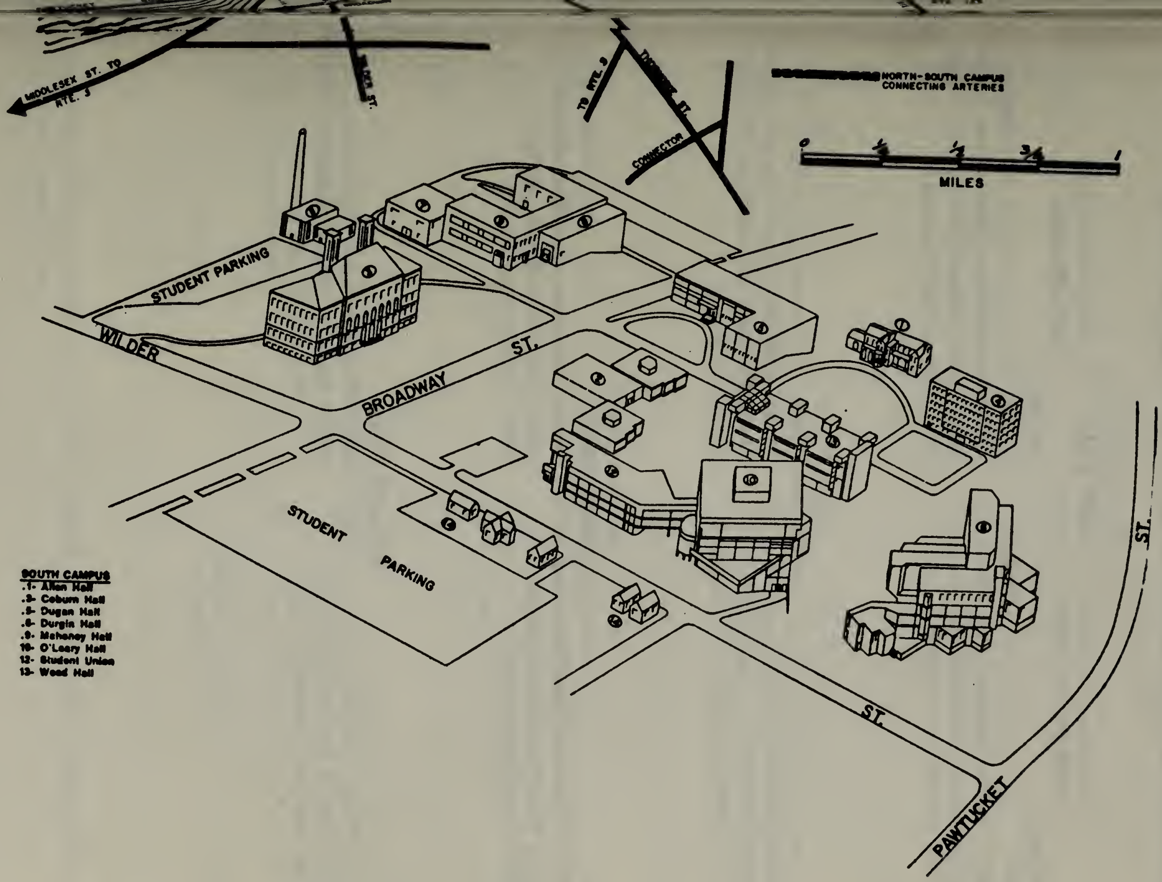
Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
20.311	Manufacturing Processes	3	68.202	Economics II	3
23.404	Mechanical Tech. Lab IV	3	69.452	Industrial Relations	3
68.201	Economics I	3	.....	Area I or Area II Elective	3
		9			9

EIGHTH YEAR

Subject No.	First Semester (Sept.)	Credits	Subject No.	Second Semester (Jan.)	Credits
20.414	Industrial Economic Management	3	20.406 or	Seminar III or Technical Elective	3
20.402	Manufacturing Operations	3	47.101	Psychology	3
......	Area I or II Elective	3	.....	Area I or II Elective	3
		9			9

All technical electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.


NORTH CAMPUS
BL- Ball Building
Cu- Cummock Hall
EB- Engineering Building
KI- Kitson Hall
NC Nuclear Center
OH- Olney Hall
OS- Olsen Hall
PA Pasteur Hall
SO Southwick Hall
Costello Gymnasium
Parking
Nuclear [NC]
Olney [OH]
Falmouth [A]
Pasteur [PA]
Engineering [EB]
Kitson [KI]
Southwick [SO]
Ball [BL]
Cumnock [CU]
Olsen [OS]
Smith
Library
Eames
Textile Avenue
Riverside Street
Standish Street
Infirmary
RTE. 113
VFW HIGHWAY
NORTH CAMPUS
TEXTILE AVE.
RIVER
RTE. 38
MAMMOTH RD.
DOWNTOWN LOWELL
RTE. 110
ST.
SCHOOL
FLETCHER
ST.
PAWTUCKET
MERRIMACK
(RTE. 113)
SOUTH CAMPUS
BLVD.
RTE. 133
N


MIDDLESEX ST. TO RTE. 3
WILDER ST.
TO RTE. 3
ST.
CONNECTOR
NORTH-SOUTH CAMPUS CONNECTING ARTERIES
0
1/4
1/2
3/4
1
MILES
STUDENT PARKING
WILDER ST.
BROADWAY ST.
STUDENT PARKING
PAWTUCKET ST.
ST.
SOUTH CAMPUS
.1- Allen Hall
.3- Coburn Hall
.5- Dugan Hall
.6- Durgin Hall
.9- Mahoney Hall
10- O'Leary Hall
12- Student Union
13- Wood Hall

BACHELOR OF SCIENCE IN TECHNOLOGY

INDUSTRIAL TECHNOLOGY—WATER AND WASTE OPTION

FIRST YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
42.101	College Writing	3	42.102	College Writing & Literature	3
90.113	Intro. to Analysis I	3	90.115	Intro. to Analysis II	3
67.201	Accounting Principles I	3	67.202	Accounting Principles II	3
		9			9

SECOND YEAR

95.141	Physics I	3	84.121	Chemistry	3
90.131	Calculus I	3	84.123	Chemistry Laboratory	3
20.121	Hydraulics for Plant Operations	3	90.132	Calculus II	3
		9			9

THIRD YEAR

20.221	Wastewater Treat. Plant Oper. I	3	20.222	Wastewater Treat. Plant Oper. II	3
20.223	Wastewater Treatment Lab I	3	20.224	Wastewater Treatment Lab II	3
92.365	Cobol Programming I	3	90.361	Fortran Programming	3
		9			9

FOURTH YEAR

20.225	Water Chemistry	3	20.226	Water Treatment Operations	3
42.112	Tech. & Sci. Communications	3	20.476	Statistical Quality Control	3
92.383	Intro. to Statistics	3	......	Area I or II Elective	3
		9			9

INDUSTRIAL TECHNOLOGY—WATER AND WASTE OPTION

FIFTH YEAR

First Semester (Sept.)			Second Semester (Jan.)		
Subject No.		Credits	Subject No.		Credits
20.107	Intro. to Engineering Design	3	20.201	Structure of Metals	3
20.109	Engineering Design Lab	3	23.323	Strenght of Materials	3
23.321.	Applied Mechanics I	3	.....	Area II Elective	3
		9			9

SIXTH YEAR

Subject No.		Credits	Subject No.		Credits
17.127	Electrical Fundamentals	3	20.408	Instrumentation & Proc. Control	3
17.129	Electrical Fundementals Lab I	3	20.410	Instrument & Proc. Control Lab.	3
27.201	Plastics Materials Science	3	.....	Free Elective	3
		9			9

SEVENTH YEAR

Subject No.		Credits	Subject No.		Credits
68.201	Economics I	3	68.202	Economics II	3
69.371	Operations Management I	3	69.452	Industrial Relations	3
......	Technical Elective	3	......	Technical Elective	
				or	
			20.306	Seminar I	3
		9			9

EIGHTH YEAR

Subject No.		Credits	Subject No.		Credits
20.414	Industrial Economic Management	3	......	Area I or II Elective	3
......	Technical Elective	3	......	Technical Elective	
				or	
				20.403 Seminar II	3
......	Area I or II Elective	3	47.101	Psychology	3
		9			9

All technical electives shall be chosen after conference with the Program Coordinator and MUST be approved by him.

ACCOUNTING

67.201 Accounting Principles I. Presents a comprehensive and detailed exposure to basic accounting theory. Beginning with the accounting equation, the student is introduced to the accounting cycle, preparation of the Statement of Financial Position and the Income Statement, and accounting for the assets of a firm. One session per week, 3 credits.

67.202 Accounting Principles II. Emphasizes the accounting for corporations, treatment of stockholders equity, earnings and dividends. Examines the Statement of Changes in Financial Position, cash flow causes and effects, and financial statement analysis. One session per week, 3 credits. Prerequisite: 67.201.

67.301 Intermediate Accounting I. This course examines the generally accepted accounting principles relating to the preparation of financial statements. The student will study in depth the valuation and disclosure problems associated with the assets of the firm. One session per week, 3 credits. Prerequisite: 67.202.

67.302 Intermediate Accounting II. This course continues the in-depth study of the valuation and disclosure problems associated with corporate liabilities and stockholders equity. Emphasis is placed on the opinions of the Accounting Principles Board and Financial Accounting Standard Board. One session per week, 3 credits. Prerequisite: 67.301.

67.311 Managerial Accounting. An in-depth examination of the use of accounting systems for managerial decision-making. Budgeting, forecasting, and cost accumulations systems which relate to the manufacturing firm will be studied. One session per week, 3 credits. Prerequisite: 67.202 (For non-accounting majors.)

67.362 Business Law I. Principles of commercial law encompassing a study of contracts, agency, employment, commercial paper and sales including the Uniform Commercial Code. One session per week, 3 credits.

67.363 Business Law II. The analysis of the legal principles underlying real and personal property, corporations, partnerships, trusts and estates. One session per week, 3 credits.

67.401 Advanced Financial Accounting I. This course explores theoretical and practical problems in accounting for large, multicorporation business entities. Consolidation, mergers, and home office/branch accounting receive in-depth study. One session per week, 3 credits. Prerequisite: 67.302.

67.402. Advanced Financial Accounting II. This course offers a comprehensive study of partnership accounting, accounting for installment and consignment sales, and also includes an introduction to accounting for nonprofit organizations (government, educational units and hospitals). One session per week, 3 credits. Prerequisite: 67.401.

67.411 Cost Accounting I. An examination of the manufacturing function from the view of the cost accountant. Managerial control of the elements of product costs will be studied with an emphasis on cost accumulation systems both historical and estimated. One session per week, 3 credits. Prerequisite: 67.202.

67.412 Cost Accounting II. Topics covered will include standard (estimated) costs, variance analysis, profit planning, cost-volume-profit analysis, and relevant cost analysis for problem solving. One session per week, 3 credits. Prerequisite: 67.411.

67.421 Auditing I. An examination of purposes of financial auditing and operations auditing. The following topics will be examined in depth: auditing standards, professional ethics, legal responsiblilties, internal control, audit evidence, financial statements disclosures, audit reports, management advisory services, and internal auditing. One session per week, 3 credits. Prerequisite: 67.302.

67.422 Auditing II. An examination of audit procedures as they relate to the various audit segments: ie., cash, fixed assets, owners equity, etc. This will be implemented via the use of text material and a comprehensive audit case. Statistical sampling will be covered in depth via the use of text material and cases when available. One session per week, 3 credits. Prerequisite: 67.421.

67.431 Federal Income Taxes. This course deals with the basic rules and regulations of the Internal Revenue Code as it affects the individual and the corporation. An understanding of the code is developed through lectures, assigned readings, research, and the solution of a wide variety of problems. One session per week, 3 credits. Prerequisite: 67.202.

ECONOMICS

68.201 Economics I. A study of the principles governing the production and exchange of goods and services. One session per week, 3 credits.

68.202 Economics II. A study of the principles governing the level of national income and employment. Examination of the commercial banking system, monetary and fiscal policy, the international economy, and alternative economic systems. One session per week, 3 credits.

68.301 Current Economic Problems. Selected problems which confront the contemporary American economy. One session per week, 3 credits. Prerequisities: 68.201 or 68.202.

68.307 Government and Business. An examination of the various governmental controls over business in the American economy. One session per week, 3 credits. Prerequisites: 68.201 or 68.202.

68.312 Managerial Economics. An economic approach to management decisions. This subject draws upon economic analysis to help formulate policy in such matters as capital budgeting, multiple product decisions, demand analysis and competitive action. One session per week, 3 credits. Prerequisites: 68.201, 68.202, 90.242.

68.332 Money and Banking. Evolution of money and credit and their role in the economy. Monetary policy and the Federal Reserve System. Structure and function of the commercial banking system and the role of other financial institutions. One session per week, 3 credits. Prerequisites: 68.201, 68.202.

BANKING

69.101 Principles of Bank Operations. Introduction to fundamentals of bank functions. A broad overview of banking and commercial bank operations. One session per week, 3 credits.

69.102 Bank Management. The study of principles of bank management. Emphasis is placed on the application of principles to the professional practice of banking. One session per week, 3 credits.

69.103 Credit Administration. Credit management dealing with principles of lending, credit investigation and analysis, and credit granting techniques. One session per week, 3 credits.

69.104 Analysis of Financial Statements. In-depth study of financial statements to determine risk in lending and investing practices. One session per week, 3 credits.

69.105 Installment Credit. A special area of credit management, installment lending, with appropriate study of character, capacity, capital and collateral. One session per week, 3 credits.

69.106 Home Mortgage Lending. Principles of bank mortgage loan portfolio management, with emphasis on residential mortgages. Study of the mortgage market, the development of the mortgage portfolio, the fundamentals of mortgages, and the processing and servicing of mortgages. One session per week, 3 credits.

69.107 Bank Investments. Specialized study of the investment problems of banking institutions with attention the unique liquidity and liability features of the banking business. One session per week, 3 credits.

69.108 Trust Functions and Services. The study of the fiduciary role of banks, including trust department operations in administration, investments and estate planning. One session per week, 3 credits.

69.109 Bank Public Relations and Marketing.. A study of the public relations and marketing aspects of banking as they would apply to relations with customers, the community, and others. One session per week, 3 credits.

69.110 Saving and Time Deposit Banking. A fundamental study of the historical development and economic function of savings process. One session per week, 3 credits.

MANAGEMENT

69.201 Principles of Management. Introduction to the principles of management, including the functions of planning, directing, organizing, and control in ralation to business. One session per week, 3 credits.

69.321 Marketing Principles. Product planning, distribution, promotion and pricing studied in the context of consumer behavior, governmental constraints and the structure of business institutions. One session per week, 3 credits. Prerequisite: 68.201.

69.331 Business Finance. Principles of financial managment, including working and fixed capital, sources of funds, financial statements, budgeting and capitalization. One session per week, 3 credits. Prerequisites: 67.202, 68.201, 68.202.

69.371 Operations Management I. Principles of production/operations management. Nature and function of production systems; operation planning and control: and plant layout; materials handling; inventory and quality control. One session per week, 3 credits. Prerequisites: 68.211

69.372 Operations Management II. Cases on the application of principles from 66.371 to problems involving continuous, intermittent and job lot production systems for both small and large firms. One session per week, 3 credits. Prerequisite: 69.371

69.410 Current Management Problems in Business and Industry I. Special problems of management in working with personnel of minority groups, blacks, women, ethnic groups and others. Extensive use is made of case studies, group projects and field studies. One session per week, 3 credits.

69.411 Current Management Problems in Business and Industry II. Advance section to 69.410. Complex problems of job boredom, worker alienation and corporate social responsibility. Solution to these problems and problems in 69.410 will be given in workshop setting. Current relevant case studies with individualized solutions. One session per week, 3 credits. Prerequisite: 69.410.

69.412 Small Business Management Seminar. A course for advanced students to study peculiar problems of small business in operations, marketing, accounting, finance and personnel, with emphasis on contemporary problems, through cases problems and readings. Open to students with 72 credits toward the BBA degree or permission of Program Coordinator. One session per week, 3 credits.

69.413 Affirmative Action -A Myth or a Must. A general overview of the mandatory governmental requirements toward providing jobs for women, blacks, and handicapped. Discussions will encompasss the actual legal requirements for developing Affirmative Action Programs and company and union attitudes. Actual case studies will be utilized. One session per week. 3 credits.

69.414 Business Systems and Procedures. A study of techniques for improved managerial controls and reduction of operating costs through improved systems. Topics covered include increased profits through improved systems, records management, information retrieval, and long range planning for business. One session per week, 3 credits. Prerequisite: 69.201.

69.415 Affirmative Action - Company Structure. A general overview of the major problems which will arise in the implementation of an Affirmative Action program within a company. The object is to point out the area of difficulty. One session per week. 3 credits.

69.416 Collective Bargaining Agreement. The nature and content of current collective bargaining agreements. Included will be the collective bargaining process including negotiations mediation and arbitration. Case studies in labor management relations involving the entire labor agreement and relationship. One session per week, 3 credits. Prerequisite: 69.452.

66.417 Real Estate. The study of evaluation, legal, financial and regulatory aspects of real estate management. One session per week, 3 credits. Prerequisite: 67.362.

69.421 Purchasing and Materials Management. Purchasing procedures, inventory control, quality control, source selection, forward buying and speculation for the production enterprise. One session per week, 3 credits. Prerequisite: 69.321 or permission of instructor.

69.426 Sales Management. Management of the personal selling function. Principles of sales force organization, selection, training, compensation, supervision and motivation are explored via appropriate cases. One session per week, 3 credits. Prerequisite: 69.321.

69.434 Investment Management. Principles of investment; security analysis, portfolio management, market analysis. One session per week, 3 credits. Prerequisite: 66.331.

69.451 Personnel Management. Recruitment, selection and training of the work force. Wage and salary administration, employee health and safety, welfare and education. One session per week, 3 credits. Prerequisite: 69.353.

69.452 Industrial Relations. Human interaction and group behavior in organized industrial settings. Union-management relations, grievance pricedures, collective bargaining, and arbitration. One session per week, 3 credits. Prerequisite: 69.451.

69.463 Management Information Systems I. Analysis and evaluation of third generation integrated software systems including hardware for requirements, routine and demand reports, architectural evaluation for integrated business function control and the data base design. One session per week, 3 credits.

69.464 Management Information Systems II. Automated decision-making models, systems user consideration, the economics of MIS, detailed case studies of large scale MIS including effects on management organization, personnel and data management. One session per week, 3 credits. Prerequisite: 69.463

69.481 Risk Management and Insurance. Analysis of pure risks of economic loss and evaluation of various methods of dealing with risk. Development and implementation of risk management programs for the business firm. One session per week, 3 credits.

69.498. Business Policy I. An integration of knowledge in the various functional areas of management toward solution of problems affecting the character and success of the total enterprise. Corporate strategy and its implementation via appropriate policies. One session per week, 3 credits. Prerequisite: senior status.

69.499 Business Policy II. A continuation of Business Policy I. Should be taken in the semester immediately following 69.498. One session per week, 3 credits. Prerequisete: 69.498.

CHEMISTRY

84.121 Chemistry. Class and demonstration. An introduction to the basic concepts of chemistry. Topics include chemical calculations, atomic structures, the periodic table, basic bonding theory, solutions, solids, liquids, gases. One session per week, 3 credits.

84.126 Chemistry. Class demonstration. A continuation of 84.121 emphasizing concepts useful to those who will directly use chemistry in further education or careers. Topics include thermodynamics, kinetics, equilibrium, acids and bases, electrochemistry, details of covalent bonding theories, and a brief introduction to organic chemistry. One session per week, 3 credits. Prerequisites: 84.121 or equivalent.

86.121 Analytical Chemistry. Class laboratory. The principles and calculations of gravimetric and volumetric analysis. One session per week, 3 credits. Prerequisites: 84.126, 90.115.

86.122 Analytical Chemistry. Class and laboratory. Advances concepts in wet methods of analysis. One session per week, 3 credits. Prerequisites: 86.121.

84.223 Organic Chemistry IB. Discussion of structure, classification by functionality, nomenclature, synthesis, reaction mechanisms, and industrial and technological applications of organic compounds. One session per week, 3 credits. Prerequisites: 86.122, 84.126. Corequisite: 86.231 or permission of instructor.

86.231 Organic Chemistry Laboratory I. Introduction to laboratory techniques in organic chemistry and application of cencepts covered in 84.223. One session per week, 3 credits. Prerequisite or corequisite: 84.223.

84.224 Organic Chemistry II B. A continuation of first semester subject 84.223. One session per week, 3 credits. Prerequisite: 84.223. Corequisite: 86.232 or permission of instructor.

86.232 Organic Chemistry Laboratory II. Laboratory application of concepts covered in 84.224. One session per week, 3 credits. Prerequisite or corequisite: 84.224.

86.341 Introduction to Physical Chemistry. A consideration of the thermodynamic approach to physical chemistry. Topics include gases, laws of thermodynamics, chemical and phase equilibria. One session per week, 3 credits. Prerequisites: 86.122, 90.132, 99.143.

84.337 Principles of Physical Chemistry Laboratory. Laboratory work designed to exemplify principles covered in 86.341. One session per week, 3 credits. Prerequisite or corequisite: 86.341.

86.342 Introduction to Physical Chemistry. Physical chemical principles of kinetics, electrochemistry, structure, and spectroscopy. One session per week, 3 credits. Prerequisite: 86.341.

84.338 Principles of Physical Chemistry Laboratory. Laboratory work to exemplify principles and applications of chemical kinetics, equilibrium, and electrochemistry. One session per week, 3 credits. Prerequisite or corequisite: 86.342.

84.334 Advanced Inorganic Chemistry. An introdution to modern theories of atomic structure and chemical bonding with emphasis on physical-chemical principles and properties. Considerable time will be spent on coordination compounds including topics such as descriptive chemistry, biochemical importance, and ligand field theory. One session per week, 3 credits. Prerequisite: 86.342.

86.352 Chemical Applications. A study of the chemical principles applied to one or more areas of industrial technology. One session per week, 3 credits. Prerequisites: 86.342.

86.361 Advanced Organic Chemistry. An in-depth coverage of properties and reactions of organic compounds stressing such aspects as synthetic methods and reaction mechanisms. One session per week, 3 credits. Prerequisites: 84.224, 86.342.

86.362 Advanced Organic Chemistry. A continuation of advanced level study of organic compounds stressing synthesis and reaction mechanisms. One session per week, 3 credits. Prerequisite: 86.361.

86.471 Industrial Chemistry. Discussion of essential chemical principles in selected areas of industrial concern, including the effects of industrial processes on the environment. One session per week, 3 credits. Prerequisites: 84.224, 86.342.

84.314 Analytical Chemistry II. The course will introduce the student to modern instrumental methods of chemical analysis. Included are such topics as ultraviolet, infrared, nuclear magnetic resonance, emission and atomic absorption spectroscopy. Mass spectrometry, thermal and electrochemical methods of analysis will be discussed. One session per week, 3 credits. Prerequisites: 86.122, 99.143. Corequisite: 84.316.

84.316 Analytical Chemistry II Laboratory. Laboratory experiments designed to complement the coverage of topics in 84.314. One session per week, 3 credits. Prerequisite: 86.122. Corequisite: 84.314.

86.481 Chemistry of High Polymers. The physical and organic chemistry of monomers and polymers, including a consideration of nonbonding forces, spectroscopic methods of structure determination, fractionation and thermodynamics. One session per week, 3 credits. Prerequisites: 84.224, 86.342.

86.482 The Chemistry of High Polymers. A continuation of 86.481. Topics presented will include methods of molecular weight determinations for polymers in solution, kinetics of condensation and addition polymerization, and mechanisms of free radical and ionic polymerization. One session per week, 3 credits. Prerequisite: 86.481.

SCIENCE

81.111 Principles of Biology I. Introduction to biological systems above the unit organismal level. Study of plants and animals with respect to reproduction and development, behavior, geneticss, evolution, ecology and biogeography. One session per week, 3 credits.

81.112 Principles of Biology II. An introduction to the structure and function of biological processes at the sub-cellular, cellular, and organismal levels. Discussions include metabolism, growth, differentiation, and physiology of plants and animals. One session per week, 3 credits.

89.101 General Geology I. A study of the Earth with emphasis on earth materials, earth structure (crustal and internal), earth history and the development of life. Gives the general student an understanding of the dynamic Earth and provides a foundation for advanced work. One session per week, 3 credits.

89.102 General Geology II. A continuation of 89.101 with emphasis on the surface of the Earth and landform development. Includes special topics, introducing the student to recent geological research and applied geological knowledge. Designed for the general and continuing student. One session per week, 3 credits.

88.141 Introduction to Weather and Climate This introductory course is designed to provide the interested student with information and knowledge about the atmosphere's dynamic reactions to energy inputs resulting in the spatial distribution of climate around the world. Also, an investigation of man's perception of climate will be included. One session per week, 3 credit.

94.201 Air Pollution Problems of air pollution including sources, atmospheric dispersion and meteorology, effect of pollutants on man and his environments, standards and controls. One session per week, 3 credits. Prerequisites: 84.126; 90.115.

94.202 Environmental Chemistry. A broad survey of the chemistry of pollutants. Included will be a characterization of pollutants in terms of chemical and physical nature and properties, sources of pollution both man and natural, and ecological consequences of pollution. One session per week, 3 credits. Prerequisite: 84.126.

94.341 Fundamentals of Science I. A study of the basic concepts of science. Topics to to covered include: the influence of the scientific method in understanding science, energy and motion, Newtonian physics, electricity, magnetism, light, atomic theory, radioactivity, and basic concepts of chemistry. Methods of scientific calculations will be treated. Audio-visual demonstrations will be presented. One session per week, 3 credits. Prerequisite: 90.112 or 90.113.

94.342 Fundamentals of Science II. A continuation of the study of the basic concepts of science. Topics to be covered include: chemical reactions, ions and solutions, the Periodic Law, basic organic chemistry, earth materials, environmental problems of physical science, human biology, and environmental biology. One session per week, 3 credits. Prerequisite: 94.341.

94.343 Intro. to Environmental Problems. An introductory course designed to develop a better understanding of Man's relationship to the environment. Lecture and lab experiments will investigate ecology and current pollution problems including air, water, radiation and land pollutants and their impact. One session per week, 3 credits.

94.345 & 94.346 Emergency Medical Care I & II. This course provides the necessary knowledge and skill to give emergency medical care at the emergency scene. The curriculum covers the basics of understanding the emergency situation, as well as specialized emphasis in respiration and resuscitation, bleeding, wounds and shock, use and care of emergency equipment commonly accepted and employed such as suction machines, oxygen delivery systems, backboards, fracture kits, obstetrical kits, stretchers of various types and light rescue tools. Also taught are management of mentally disturbed patients, and initial care of poison and burn patients along with environmental emergencies. Included in the course are lectures on anatomy and physiology by local physicians. Successful completion of the course entitles one to take the National Registry Exam for Emergency Medical Technician. One session per week, 3 credits per semester.

95.141 Physics I. Class and laboratory. The principles of statics and dynamics including equilibrium of a particle and of a rigid body, motion in one dimension and in the plane, particle dynamics and gravitation. One session per week, 3 credits. Prerequisite: 90.115 (May be taken concurrently).

99.142 Physics II. Class and laboratory. Work and energy, impulse and momentum, rotational dynamics, elasticity, harmonic motion, hydrostatics and hydrodynamics. One session per week, 3 credits. Prerequisites: 95.141; 90.115. (May be taken concurrently).

99.143 Physics III. Class and laboratory. Temperature and expansion, quantity of heat, transfer of heat, first and second laws of thermodynamics, thermal properties of solids, liquids, and gases, wave motion, vibrating bodies, and acoustical phenomena. One session per week, 3 credits. Prerequisite: 99.142.

MATHEMATICS

All mathematics courses, including those designated as Computer Science, except 90.010 and 90.111 are transferable to the University of Lowell day division upon appropriate University approval. Courses with the prefix 92 are equivalent to those in the day school with the same number. Day school students wishing to elect courses with the prefix 90 must consult the Chairperson and/or Coordinator in order to ascertain course (s) equivalence.

90.010 Introductory Mathematics. A transitional course designed for students with a limited mathematics background. The main purpose of this course is to give students an insight into the structure of basic mathematics including algebra, and to increase the student's manipulative skills in this area. One session per week, 3 credits.

90.111 Mathematics A. Real numbers, factoring, fractions, linear equations in one unknown, functions and graphs, exponents and radicals, systems of linear equations, and the quadratic equation. Emphasis is placed on the solution of word problems. One session per week, 3 credits. Prerequisite: Two years of high school mathematics, including one year of algebra.

90.112 Mathematics B. Mathematics for Business Administration Majors. Includes: Set theory, algebraic equations, coordinate geometry, relations and functions, and linear functions with applications to business. One session per week, 3 credits. Prerequisite: 90.111 or satisfactory score on Math Placement Test.

90.113 Introduction to Analysis I. Review of algebra, equations, functions, inequalities and quadratic functions, systems of linear equations and inequalities, exponential and logarithmic functions, circular functions. One session per week, 3 credits. Prerequisite: satisfactory score on the Evening School Mathematics Placement Test or 90.111 or equivalent.

90.115 Introduction to Analysis II. Trigonometric functions and identities, inverse functions; vectors and applications, complex numbers, polynomials, equations of second degree and their graphs, series. One session per week, 3 credits. Prerequisite: 90.113.

90.119 Mathematics C. Mathematics for Business Administration majors. Includes: Non linear algebraic functions, transcendental functions, logarithms, functions in finance, inequalities and linear programming and calculus with business applications. One session per week, 3 credits. Prerequisite: 90.112.

90.130 Calculus for Business Administration. Graphical representation: straight lines and equations. Limits. Differential Calculus of one variable, with applications to optimization. Marginal Analysis. Composite and implicit functions. Higher order derivatives. Partial derivatives. Introduction to Integral Calculus with applications in economics. Further integration techniques and applications. One session per week, 3 credits. Prerequisite: 90.119.

90.131 Calculus I. Rate of change of a function, derivatives of algebraic functions, applications of the derivative, and introduction to integration. One session per week, 3 credits. Prerequisite: 90.115.

90.132 Calculus II. Applications of the definite integral, transcendental functions, and methods of integration. One session per week, 3 credits. Prerequisite: 90.131.

90.211 Modern Concepts in Mathematics. College level coverage of fundamental concepts including sets, logic, relations and functions, and mathematical systems. One session per week, 3 credits. Prerequisite: 90.115.

90.221 Applied Linear Algebra I. An introduction to sets and mathematical logic. The basic properties of linear mappings, matrices, scalar products and orthogonality, systems of linear equations. Applications of the above. One session per week, 3 credits. Prerequisite: 90.132.

90.222 Applied Linear Algebra II. Matrices and bilinear forms; symmetric, hermitian and unitary operators, eigenvectors and eigenvalues: the Caley Hamilton, Sylvester and Spectral Theorems. Applications of the above. One session per week, 3 credits. Prerequisite: 90.221.

90.231 Calculus III. Methods of integration, determinants of the order "n", hyperbolic functions, polar coordinates, vector analysis and space coordinates. One session per week, 3 credits. Prerequisite: 90.132.

90.232 Calculus IV. Partial differentiation, directional derivatives, gradients, exact differentials, line integrals, multiple integrals, surface area, Taylor's Theorem, Fourier series, and complex functions. One session per week. Prerequisite: 90.231.

90.241 Statistics for Business I. Descriptive statistics, sophisticated counting techniques and other components of probability, simple random variables and their distributions, bivariate functions, sampling theory, properties of estimators, confidence intervals, and hypothesis testing. One session per week, 3 credits.

90.242 Statistics for Business II. Analysis of variance, applied regression theory, correlation analysis, and other selected topics. One session per week, 3 credits. Prerequisite: 90.241.

92.206 Elementary Statistical Analysis. A course designed primarily for the social scientist. Includes graphic presentations, measures of central tendency, variability, correlation, standard scores and the unit normal distribution, hypotheses and statistical inference, and tests of significance. One session per week, 3 credits. For Medical Technology and Nursing students only.

92.301 Applied Mathematics I. Matrices. Vector analysis, review of vector algebra, vector calculus, divergence theorem. Green's theorem and Stokes' theorem. One session per week, 3 credits. Prerequisite: 92.314.

92.302 Applied Mathematics II. Series solutions of ordinary differential equations, Bessel functions, Legendre functions. Ordinary differential equations, boundary value problems. Fourier series and integrals. Partial differential equations of physics and engineering, separation of variables. One session per week, 3 credits. Prerequisite: 92.301.

92.314 Differential Equations. A course in ordinary differential equations including equations of order one, linear differential equations, nonhomogeneous equations, method of undetermined coefficients, the Laplace transform, systems of equations, electric circuits and networks, existence and uniqueness of solutions, and nonlinear equations. One session per week, 3 credits. Prerequisite: 90.232.

90.315 Partial Differential Equations I. Basic concepts in partial differentiation. Classification and solution of first order and higher order linear partial differential equations. Introduction to Bessel, Legendre, and other orthogonal functions. Boundary value problems, including application of Fourier Series, Fourier Integrals, and Laplace Transforms. One session per week, 3 credits. Prerequisite: 92.314.

92.362 Methods in Numerical Analysis I. Theory and applications of numerical techniques including: error analysis, non-linear systems of equations, matrices, eigenvalues, interpolation and collocation of polynomials, numerical integration. Computer solutions are emphasized. One session per week, 3 credits. Prerequisites: 90.361; 90.231.

90.454 Methods in Numerical Analysis II. Continuation of 92.362 including: numerical solution of ordinary and partial differential equations, boundary value problems, curve-fitting, linear programming, error analysis and computer solutions. One session per week, 3 credits. Prerequisite: 92.362.

92.381 Operations Research I. The use of decision models in industrial systems. Quantitative approach to the industrial alternative. Fundamentals of probability and statistics, PERT techniques, methods of optimization using calculus, inventory control models and queueing models. One session per week, 3 credits. Prerequisite: 90.132 or 90.130.

92.382 Operations Research II. A continuation of 92.381. Topics include: linear programming, transportation models, nonlinear programming, dynamic programming, games and strategies, Markov analysis, and simulation techniques. One session per week, 3 credits. Prerequisite: 92.381.

92.383 Introduction to Statistics. Sets and probability laws, random variables, mathematical expectation, measure of central tendency and variance. Study of discrete and continuous probability distribution, sampling theory, tests of hypothesis. Regression and correlation. One session per week, 3 credits. Prerequisite: 90.113.

92.407 Introduction to Probability Theory. Probability functions and densities, expectations. Moments of probability distributions. Central limit theorem. One session per week, 3 credits. Prerequisite: 90.232.

92.408 Introduction to Mathematical Statistics. Sampling, decision theory, estimation, hypothesis testing, regression and correlation. One session per week, 3 credits. Prerequisite: 92.407.

92.411 Complex Variables I. Complex numbers. Functions of a complex variable. Mappings. Derivatives. Analytic functions. Elementary functions. Integrals. Laurent series. Residues and poles. Contour integration. One session per week, 3 credits. Prerequisite: 90.232.

92.412 Complex Variables II. Transformations. Conformal mappings. Boundary conditions. Application in heat conduction, electrostatic potential, and fluid flow. Gamma and beta functions. Inverse Laplace transform. Riemann surfaces. One session per week, 3 credits. Prerequisite: 92.411.

92.421 Abstract Algebra I. Elementary group theory, groups, cosets, normal subgroups, quotient groups, isomorphisms, homomorphisms, series of groups, the Sylow theorems, free groups and homology groups. One session per week, 3 credits. Prerequisite: 90.132.

92.422 Abstract Algebra II. Elementary ring and field theory, quotient rings and ideals, homomorphisms of rings, rings of polynomials, algebraic extensions, automorphisms of fields, separable extensions. Galois Theory. Introduction to categories and functions. One session per week, 3 credits. Prerequisite: 92.421.

92.442 Boundary Value Problems. The Fourier series as a tool of analysis. Orthogonal functions, convergence tests, the Fourier integral partial differential equations of physics and engineering, and boundary value problems. One session per week, 3 credits. Prerequisite: 90.315.

92.498 Mathematics Seminar. Student reading, writing, and criticism of topics from current literature. Review of some important elements of undergraduate work. One session per week, 3 credits. Prerequisite: permission of Coordinator.

COMPUTER SCIENCE

(Students registering for programming courses may be required to spend non-class time at the Institute's Computer Center.)

90.251 Computers I. Computer fundamentals for business including: computer numbering systems and organization, instruction sets, data elements, introduction to programming, flow charting, input-output devices and media, a survey of programming languages and computer economics. One session per week, 3 credits.

90.252 Computers II. A continuation of 90.251 including the roles and tools of the systems designer and various levels of management in creating computerized business systems, feasibility studies, economics of corporate computer use and its impact at all levels. One session per week, 3 credits. Prerequisite: 90.251.

90.361 Fortran Programming. A detailed study of the universal FORTRAN programming language including input-output, arithmetic, control, and specification statements, sub programs and advanced techniques, numerous examples and routines. Students will program several problems with completion on a high-speed digital computer. One session per week, 3 creditss. Prerequisite: 90.112 or 90.113.

92.209 Introduction to Theory of Computer Programming. An introduction to the processing of information by computers. Computer logic, memory, inputs and outputs, timesharing, flowcharting techniques, and programming in the BASIC and/or FORTRAN languages. One session per week, 3 credits. For Medical Technology and Nursing students only.

92.363 Introduction to Computers. Types of computers and their operation. Characteristics, storage, and calculation principles. Addressing schemes. Computer arithmetic and logic, numbering systems, instruction codes, input-output organization and devices, organizing computer files and data communications. One session per week, 3 credits.

92.365 Cobol Programming I. Programming principles of COBOL, the Common Business Oriented Language; identification, environment, data, and procedures divisions, introduction to compilation procedures and diagnostic processing. Programming of basic business applications such as inventory and accounting problems. One session per week, 3 credits.

92.366 Advanced Fortran Programming. Advanced FORTRAN programming techniques employing subroutines, subprograms, flowcharting and documentation. Topics will include random number generation, simulation and file manipulation. One session per week, 3 credits. Prerequisite: 90.361.

92.367 Assembler Language Programming I. Absolute machine language coding and the symbolic programming language; the coding of practice problems on a high-speed digital computer using the basic computer instructions including arithmetic, input-output, logic, control operations and data manipulation. One session per week, 3 credits. Prerequisite: 92.363 or 90.361.

92.368 Cobol Programming II. A continuation of 92.365. Advanced programming problems in COBOL, discussion of COBOL systems software, sophisticated routines and generalized business file manipulation. One session per week, 3 credits. Prerequisite: 92.365.

92.461 Systems Simulation and Modeling. Procedures in model construction and computerized simulation, modeling tools and techniques, model conceptualization and implementation, selected applications of simulation. One session per week, 3 credits. Prerequisites: 90.361;92.383.

92.462 Advanced Programming Systems. Basic concepts of assembly programs and compilers, macro-generators, utility programs, supervisions, monitors and high level languages. One session per week, 3 credits. Prerequisite: 92.367.

92.463 Systems Design and Development I. A general study of the design and development of computer-oriented data processing systems including: the approach requirements of the system, developing the solution, data controls, system controls, system evaluation and reporting to management. One session per week, 3 credits. Prerequisite: 92.367.

92.464 Systems Design and Development II. A continuation of 92.463 including: finalizing and implementing the system, post-installation evaluation, and interdepartmental coordination, case studies. One session per week, 3 credits. Prerequisite: 92.463.

92.467 Assembler Language Programming II. A continuation of 92.367. Symbolic programming using advanced techniques including macro instructions, indirect addressing, file generation and processing, magnetic tape and magnetic disk applications. One session per week, 3 credits. Prerequisite: 92.367.

92.468 Minicomputer Principles and Applications. Current minicomputer practices covering both hardware and software including basic minicomputer instructions sets, operating systems, assembler and I/O programming, utilities, interrupts, and interfaces. Scientific, industrial and business applications throughout. One session per week, 3 credits. Prerequisites: 92.367;90.132.

92.469 Compiler Construction Techniques. Typical compiler organization is studied including symbol tables, various types of scans, object code generation, error diagnostics, and optimization techniques. Segments of a classroom compiler are written by students. One session per week, 3 credits. Prerequisite: 92.367.

92.470 Remote Computing. Analysis and use of remote computing systems including time-sharing, remote batch and real-time systems. Design characteristics, applications, data communication, economics and management of such systems. One session per week, 3 credits. Prerequisite: 92.367.

92.471 Managing the Data Processing Function. Administering and controlling the company data processing activity; programming administration, DP project management, evaluating and training personnel, equipment selection, cost estimating and control. One session per week, 3 credits. Prerequisite: 92.463.

CIVIL ENGINEERING TECHNOLOGY

15.123 Surveying I. Class and laboratory. Principles of data gathering by surveying processes. Theories and methods of instrumental techniques for measurement of lengths, directions, coordinates, areas, volumes and topographic data. Problems are used to illustrate processing of fieldwork data. Illustrative fieldwork projects to give facility in basic surveying techniques. One evening session per week, and five Saturdays of fieldwork. 3 credits. Prerequisites: 90.115;23.111.

15.124 Surveying II. Class and laboratory. A continuation of 15.123. Application of basic surveying techniques of engineering problems implicit in transportation engineering, industrial and domestic housing, utilities for the safety and convenience of humans, use of land resources and the supply and control of water. Fieldwork projects typical of the applications of surveying to engineering. One evening session per week, and five Saturdays of fieldwork. 3 credits. Prerequisite: 15.123.

15.237 Statics. The fundamentals of statics, including such topics as force systems, resultants, equilibrium, friction, first moments of masses and areas. One session per week, 3 credits. Prerequisites: 90.132; 95.141.

15.238 Dynamics (CE). Laws of kinematics of particles and rigid bodies involving absolute and relative motion. Newton's laws as applied to the kinetics of rigid bodies in motion. Principles of work and energy; impulse and momentun. One session per week, 3 credits. Prerequisites: 90.132;15.237; or 23.221.

15.239 Strength of Materials (C.E.). Principles of strength of materials, centric, torsional, and flexural loading, principal stresses. Mohr's stress cycle, strain, temperature effects, shear and moment diagrams. One session per week, 3 credits. Prerequisites: 90.132;15.237; or 23.222.

15.242 Steel Design I. The selection and proportioning of structural steel members to resist axial, shearing, bending and combined stresses. The design of simple riveted, bolted and welded connections. One session per week, 3 credits. Prerequisites: 15.251; 15.239; or 23.223.

15.243 Construction Materials. Class and laboratory. Properties of materials used in engineering highways and structures. Discussion of metals, timber, cement, mortars, concrete aggregates, oils, asphalts, and other building materials. One session per week, 3 credits. Prerequisite: 99.142.

15.246 Introduction to Hydraulics. Properties of fluids, principles of hydrostatic pressure, fluid flow with applications to orifices, tubes, weirs, and pipes. One session per week, 3 credits. Prerequisites: 99.142; 15.238; or 23.222.

15.251 Structural Analysis I. Analysis of statically determinate structures. Reactions and stresses, framed structures, beams, trusses, graphic statics, roof trusses, truss and girder bridges, long span bridges, and lateral bracing and portals. One session per week, 3 credits. Prerequisite: 15.239

15.253 Concrete Analysis and Design I. The selection and design of reinforced concrete members to resist axial, shearing, bending and combined stresses by the Working Stress Design method and the Strength method. Design of rectangular beams, T-beams, and slabs. One session per week, 3 credits. Prerequisites: 15.251;15.239 or 23.223

15.254 Soil Mechanics I. An elementary treatment of the physical properties of soils such as bearing and shearing strengths, soil moisture content, compressibility, consolidation, and settlement. The applications of such soil properties to typical foundations as piles, caissons and spread footings. one session per week, 3 credits. Prerequisites: 15.243;23.223

15.255 Environmental Engineering I. Class and laboratory. A basic study of the field of sanitary engineering, with particular emphasis on the treatment of water and waste water, design of sewers, appurtenances, loads on buried pipes, sewer trenches, and handling of water and sewage. One session per week, 3 credits. Prerequisites: 15.124;90.131.

15.257 Highway Elements. An integral presentation of the broad field of basic highway principles covering highway administration, economics and finance, planning, design, soils, drainage, earthwork operations, pavements, surface types, cements, and highway maintenance. One session per week, 3 credits. Prerequisite: 15.124

15.352 Structural Analysis II. A continuation of 15.251. Deflection calculations for beams, trusses, and frames. Analyses of trusses, beams, and frames by energy methods and moment distribution. One session per week, 3 credits. Prerequisite: 15.251

15.356 Environmental Engineering II. Class and laboratory. A continuation of 15.255 with emphasis on stream pollution, industrial waste treatment, refuse disposal, air pollution, and swimming areas. One session per week, 3 credits. Prerequisite: 15.255

15.383 Steel Design II. A continuation of 15.242. Design of beam-columns, moment-resisting connections, built-up plate girders, and composite beam and slab sections. Consideration of basic structural members as elements within frame and floor systems. One session per week, 3 credits. Prerequisite: 15.242.

15.391 Concrete Analysis and Design II. A continuation of 15.253. The anlysis of and design for the behavior of the basic concrete members in structural frames and floor systems. The use of design curves and graphs as an aid to the solution of practical problems. One session per week, 3 credits. Prerequisite: 15.253.

15.392 Soil Mechanics II. A continuation of 15.254 with emphasis on application of principles. The use of field and laboratory tests in the design of foundation and the treatment of embankments. One session per week, 3 credits. Prerequisite: 15.254

15.394 Soil Mechanics Lab. Common soil laboratory tests including soil classification gradation, atterberg limits, strength and compressibility tests. One session per week, 3 credits. Prerequisite: 15.392.

15.461 Advanced Surveying. Application of higher surveying techniques to the providing of information and the solution of engineering problems. Topics covered include precise measurement of angles, methods of determining elevations with high precision, consideration of photogrammetric techniques, and the basic principles of engineering astronomy. One session per week, 3 credits. Prerequisites: 15.124;90.231.

15.486 Transportation Elements. A continuation of 15.257. Presentation of selected topics in the field of transportation such as traffic, integrated public transportation, planning and developmental impact of transportation routes. One session per week, 3 credits. Prerequisite: 15.257.

15.495 Civil Engineering Elective. Advanced topics from the sub-disciplines of Civil Engineering; that is structures, transportation, sanitary engineering or soil mechanics. Offered at student request and conditional on sufficient enrollment. One session per week, 3 credits. Prerequisites: Completion of the required courses in the sub-discipline in which course is offered.

ELECTRONIC ENGINEERING TECHNOLOGY

17.127 Electrical Fundamentals. Class and laboratory. An introduction to the basic principles of electricity; including the concept of voltage, current, resistance, inductance, and capacitance; Ohm's and Kirchoff's Laws; Thevenin's and Norton's theorems; laboratory instruments. Also included is a basic introduction to the various types of sensors (temperature, acceleration, strain, light, radiation, etc.) and active devices such as the transistor. One session per week, 3 credits. Prerequisites: 90.115; 99.142 (both may be taken concurrently).

17.128 Basic Electronics. Class and laboratory. A continuation and elaboration of the topics covered in 17.127. Particular emphasis is placed on the characteristics of solid state active devices and their interconnection with sensors and transducers. Theory includes analysis of power supplies and filters; current, voltage, and power amplifiers; and oscillators. One session per week, 3 credits. Prerequisite: 17.127

17.129 Electrical Fundamentals Laboratory. An introduction to basic laboratory instruments and electronic components. Resistors, inductors, and capacitors; meters; cathode-ray oscilloscope; power supplies; oscillators and signal generators; bridges; and diode characteristics and applications. Written laboratory reports are required. One session per week, 3 credits. Corequisite: 17.127.

17.223 Electric Circuits I. Class and laboratory, units of voltage, current, and resistance; voltage and current sources; charge; energy and power; resistance of conductors; Kirchoff's laws; basic network theorems; fundamentals of magnetism; magnetic circuits; and meters. One session per week, 3 credits. Prerequisites 90.131, 99.142 (both may be taken concurrently).

17.224 Electric Circuits II. Class and laboratory. A continuation of 17.223. Inductance and capacitance, simple inductive and capacitive circuits; alternating current and voltage; phasor algebra; inductive and capacitive reactance; impedance and admittance; passive networks; equivalent networks and sources; dependant sources; power in alternating-current circuits; resonance; transformer principles; and polyphase circuits. One session per week, 3 credits. Prerequisites: 17.223, 90.132 (May be taken concurrently).

17.225 Electric Circuits III. An extension and elaboration of the principles covered in 17.223 and 17.224. Analysis of circuits and systems undergoing transient conditions caused by a variety of excitations, both natural and forced, utilizing the Lapace-Transform method. Application to mechanical, fluidic, thermal circuits and filters are presented as an introduction to electromechanical, electronic and control systems. One session per week, 3 credits. Prerequisites: 17.224, 90.132 (may be taken concurrently).

17.237 Electronics Laboratory. An introduction to basic laboratory instruments and electronic components. Resistors, inductors, and capacitors; meters; cathode-ray oscilloscope; power supplies, oscillators and signal generators; bridges and semiconductor characteristics and applications. Written laboratory reports are required. One session per week, 3 credits. Prerequisite: 17.224

17.240 Electromechanics. A combination lecture and laboratory course, introducing magetic circuits, transformers, and both alternating current, and direct current rotating machines. One session per week, 3 credits. Prerequisite: 17.224

17.241 Energy Conversion. The fundamentals of the five major methods of direct energy conversion, that is, thermoelectricity, photovoltaics, thermionics, magnetohydrodynamics and fuel cells will be studied. The study will include various energy storage methods and conversion techniques. One session per week, 3 credits. Prerequisites: 17.240, 17.362, 99.142.

17.350 Control Systems I. An introduction to linear servomechanism theory; dynamic analysis of linear systems; Laplace transform; dynamic response of physical systems complex plane analysis; automatic feedback control; and stability analysis. One session per week, 3 credits. Prerequisites: 17.225, 90.132, 99.142.

17.359 Electronics Laboratory. Experiments on solid-state devices and circuits, analog and digital, are performed with emphasis in their fundamental operation and usage. Written laboratory reports are required. One session per week, 3 credits. Prerequisites: 17.237, 17.240, 17.362.

17.360 Electronics Laboratory. Students are required to perform state-of-the-art experiments related to the latest solid-state devices (analog and digital) available. Use of the computer as a tool to solve experimental problems is encouraged. A final exam (oral and written) and several written laboratory reports are required. One session per week, 3 credits. Prerequisites: 17.359, 17.363.

17.361 Electronics Laboratory. Projects are assigned. Students submit detailed proposals. The best feasible projects proposed are then assigned to teams of students for implementation. Use of the computer as a tool to solve experimental problems is encouraged. Written laboratory reports are required. One session per week, 3 credits. Prerequisites: 17.360, 17.364.

17.362 Electronics I. An introduction to electronics with emphasis on solid-state physics and devices. The PN junction, graded and abrubt, is discussed under various biasing conditions. Related subjects such as depletion capacitance, diffusion capacitance, zener and avalanche breakdown are covered in detail. Various types of PN junction diodes, PIN, zener, varactor, photo, step recovery, etc., are discussed with respect to circuit applications. Diode circuits and applications such as the voltage doubler, limiters, and rectifiers are studied. An introduction to the theory of transistor operation is also included. One session per week, 3 credits. Prerequisites: 17.224, 90.132, 99.142.

17.363 Electronics II. A continuation of the study of transistor theory and operation started in 17.362. Small signal equivalent circuits such as the t, hybrid-pi, and y are discussed with emphasis on the frequency limitations of each model. Biasing is discussed and studied from a feedback viewpoint. The gain and impedance characteristics of the three basic transistor configurations are investigated and compared. The study of single stage, multistage, tuned, and power amplifiers is also included. One session per week, 3 credits. Prerequisite: 17.362.

17.364 Electronics III. A continuation of 17.363. Devoted to the study and application of active devices such as vacuum tubes, transistors, field-effect transistors, unijunction transistors and silcone-controlled rectifiers. Feedback amplifiers are discussed considering advantages and disadvantages of feedback stability requirements and frequency response. The concept of positive feedback with respect to the various types of oscillator circuits is discussed and analyzed. Also included is an introduction to pulse and digital circuits, an area that will be expanded and covered with greater depths in the electives 17.415 and 17.416. One session per week, 3 credits. Prerequisite: 17.363.

17.365 Integrated Circuits I. The characteristics and applications associated with both linear and non-linear integrated devices are studied. Optimal use of industry published specifications, application notes and handbook data will be stressed. Topics include: Operational Amplifiers, Regulators, Comparators, Analog Switches, Time-Function Generators, Instrumentation Circuits, Logarithmic Circuits, Computing Circuits and Signal Processing Circuits. One session per week, 3 credits. Prerequisites: 17.350, 17.364, 17.372.

17.366 Integrated Circuits II. A continuation of 17.365 primarily emphasizing the characteristics and applications of digital integrated devices, data acquisition, and data conversion. Topics include: Analog to Digital and Digital to Analog Converters, Sample and Hole Modules, Logic Families (TTL, CMOS, ECL, MECL, etc.), Large Scale Integrated Circuits (ROM'S, RAM's etc.). One session per week, 3 credits. Prerequisites: 17.365.

17.371 Logic Design I. The fundamentals of arithmetic, algorithms, devices and sub systems which are common to all digital computational hardware systems will be taught. Topics include: number systems, precision and resolution, binary and decimal coding, register processing and display. Traditional algebraic and charting techniques for the efficient combining of fundamental operational and memory building blocks will be combined with the formating of logic problems toward computer solution. One session per week, 3 credits. Prerequisites: 17.224, 90.132.

17.372 Logic Design II. An extension of the principles of Logic Design I to sequential circuits and processor systems. State diagrams, tabular and graphical techniques will be applied to several classes of sequential systems in order to teach design skills for the highly reliable logic circuits. Operational equations for both real and hypothesized devices will form the basis for design to equip the student for both current and future computer technologies. One session per week, 3 credits. Prerequisite: 17.371.

17.376 Electromagnetic Theory. Vector analysis; electric field intensity; electric flux density; Gauss's law; divergence; energy; potential; conductors; dielectrics;capacitance; Poisson's and Laplace's equations; magnetic field; magnetic forces; inductance; Faraday's law; Maxwell's equations; uniform plane waves; wave motion; the Poynting vector and power; skin effect; and standing-wave ratio. One session per week, 3 credits. Prerequisite: 92.314.

17.381 Engineering Problem Solutions I. A culmination and sophistication of the problem solving techniques used throughout the Electronic Engineering Technology Program. The digital computer will be used extensively as an aid in the solution of these problems. One session per week, 3 credits. Prerequisites: 17.225, 92.314.

17.382 Engineering Problem Solutions II. An extension and elaboration of the problem solving techniques presented in 17.381. One session per week, 3 credits. Prerequisites: 17.372, 17.381.

17.391 Project Laboratory I. Students are required to submit project proposals compatible with the advanced technical electives offered. Teams are then assigned to implement selected projects. Use of the computer as a tool to solve experimental problems is encouraged. Written laboratory reports are required. One session per week, 3 credits. Prerequisites: 17.361, 17.366.

17.392 Project Laboratory II. A continuation of the projects of the type offered in 17.391. One session per week, 3 credits. Prerequisite: 17.391.

17.413 High Frequency Techniques I. An introduction to microwave theory, measurement, and applications. The course begins with an introduction to Maxwell's equations and proceeds immediately into guided wave concepts. Transmission line theory is presented and is used as an underlying and unifying basic body of material for this and succeeding course. Many basic concepts are then brought into focus by extensive use of example problems. Hollow waveguides are introduced briefly and their uses and applicationss are mentioned. The basic principles of microwave networks is presented and explained by examples of the scattering matrix. The above is considered to take ½ of the course. The remainder utilizes the basic concepts to investigate microwave oscillators, amplifiers, modulators, filters, etc. The classic tube devices such as the traveling wave tube, klystron, etc. are briefly covered, and then considerable emphasis is given to the area of microwave semiconductor devices. The semiconductor devices to be discussed include Gunn, IMPATT, PIN, and varactor diodes. Microwave integrated circuits and high frequency transistor circuits and applications complete the course. One session per week , 3 credits. Prerequisite: 90.232.

17.414 High Frequency Techniques II. A review of the concepts from the previous course is presented and more salient features are now considered. Transient and steady state concepts descussed and more detail of basic measurement procedures presented. Waveguides as circuit elements are now thoroughly investigated, this includes passive filters and uses for cavity oscillators. Solid state (Gunn, IMPATT) oscillators considered in depth with discussion of noise, tuning, stability. Microwave signal processing using PIN diodes and varactor diodes is covered. Ferrite devices, time domain reflectometry, and antenna fundamentals complete the course. One session per week, 3 credits. Prerequisite: 17.413.

17.415 Pulse Techniques I. Linear wave shaping, pulse transformers; steady state switching characteristics of devices; clipping and comparator circuits; clamping and switching circuits; and logic circuits. One session per week, 3 credits. Prerequisite: 17.364.

17.416 Pulse Techniques II. Bistable, monostable, and astable multivibrators; negative-resistance devices; negative-resistance switching circuits; blocking-oscillator circuits; time base generators; and transient switching characteristics of diodes and transistors. One session per week, 3 credits. Prerequisite: 17.415.

17.417 Minicomputer Programming An introduction to fundamentals of absolute and symbolic programming. Typical digital computer organization and operation from a register-reference point of view. Computer word formats, instructions, and symbolic coding. Address modification, index registers and looping. Use of system programs including Debrig, Editor, and assembler. Subroutines: calling sequences, multiple entry and return. Programs assignemnts will be run by students on one of the University's minicomputers. One session per week, 3 credits. Prerequisite: 17.382.

17.433 Switching Circuits and Logical Design I. A continuation of the digital concepts covered in 17.371 and 17.372. Topics include Boolean function minimization; incompletely specified functions; tabular minimization techniques; multiple output circuits; error detecting and error correcting codes; sequential circuits. One session per week, 3 credits. Prerequisite: 17.372.

17.434 Switching Circuits and Logical Design II. A continuation of 17.433 including, clocked sequential circuits, state diagrams and tables; equivalent states; simplification of sequential machines; incompletely specified sequential circuits; pulse-mode circuits; fundamental mode sequential circuits; and threshold logic. One session per week, 3 credits. Prerequisite: 17.433.

17.485 Communication Theory I. Introduction to information, transmission and communication systems. Review of four year Fourier Series and four year interval, discussion of amplitude and frequency modulation systems and introduction to noise in electrical systems. One session per week, 3 credits. Prerequisite: 17.376.

17.486 Communication Theory II. Continuation of theory I. P.A.M., P.C.M. and P.P.M. systems will be discussed and analyzed. Propagation in free space, antenna theory and propagation characteristics of the ionsphere will be presented. One session per week, 3 credits. Prerequisites: 17.485, 92.314.

17.487 Filter Design I. A review of network analysis, introduction of synthesis of driving point impedance, approximation theory, and transfer function realization. One session per week, 3 credits. Prerequisites: 17.350, 92.314.

17.488 Filter Design II. Introduction to analysis and synthesis of active filters. Negative resistance, controlled sources, negative impedance converters and gyrators will be discussed. However, course emphasis will be placed on the operational amplifier as a network element. One session per week, 3 credits. Prerequisite: 17.487.

17.453 Transmission Theory I. Transmission systems, reactance, capacitance, three-phase line calculations, corona power, lighting arresters, transmission structures, transformer substations, distribution circuits, and automatic substations. One session per week, 3 credits. Prerequisite: 17.241 (may be taken concurrently).

17.454 Transmission Theory II. A continuation of 17.453. Onse session per week, 3 credits. Prerequisite: 17.453.

17.469 Control Systems II. A continuation of 17.350. Control loop design; real frequency and transient response; Nyquist stability criterion; compensation, optimum design; nonlinear systems; and a.c. carrier servomechanisms. One session per week, 3 credits. Prerequisite: 17.350.

17.480 Microprocessors. The hardware, software, and applications associated with several types of microprocessors will be investigated. One session per week, 3 credits. Prerequisite: 17.417.

17.494 Telecommunications Engineering. Telephone channels systems objectives for human and machine interface. The switched telephone network hierarchy. Local channel performance, noise, echo, design loss and crosstalk. Frequency division multiplex systems. Time division multiplex systems. Characteristics of carrier equipment. Digital data transmission. Coaxial systems. Optical Telephony. EIA and CCITT standards. Network design, topological considerations. Service availability, line usage and blocking. Facsimile, telex. Regulation of common carriers, tariffs. User applications including PABX system analysis. One session per week, 3 credits. Prerequisites: 17.225, 17.371.

17.497 Biomedical Electronics I. The first semester will include a brief review of circuit design techniques particularly applicable to biomedical electronics. Emphasis will be placed upon small signal, low noise amplifiers and signal processors. Frequency, power spectrum, shaping and filtering techniques necessary for biomedics will be presented from a designer's viewpoint. This material will be followed by the development of easily applied design algoithms for the most common circuit types found in biomedical instrumentations and systems. Both single and double ended circuit structures will be considered. Further, the design of the various types of analog and digital displays required in biomedical systems will be taught. The use of the most current device and system technology will be emphasized throughout the course. One session per week, 3 credits. Prerequisites: 17.350, 17.364, 84.121.

17.498 Biomedical Electronics II. Second semester work will consist of three component phases. The first phase will include a presentation of selected topics in anatomy and physiology. These are requisite to an in-depth understanding of the biomedical applications of the circuit and system design techniques presented during the first semester. The second phase will be focused on the use of the circuit design techniques of the first semester combined with the anatomical considerations of phase I in the design of the most commonly needed biomedical instrumentation devices. The educational focus during this phase will be at the equipment level. The third phase will focus on the system level considerations and will discuss the design of biomedical electronic systems. Intensive care unit operating suite systems are two examples of those to be discussed. Implementation and cross-professional acceptance problems will be discussed as time allows. One session per week, 3 credits. Prerequisite: 17.497.

INDUSTRIAL ENGINEERING TECHNOLOGY

21.254 Plant Lay-Out and Materials Handling. A study of materials flow, layout production, assembly and service departments, manufacturing, buildings, service facilities, handling equipment, and packaging techniques. One session per week, 3 credits. Prerequisite: 20.351.

21.256 Production Measurements. Measurement, description and prediction of the rate and quality of an output from production systems. A study of control charting methods, work sampling, performance standards, process control and estimation. One session per week, 3 credits. Prerequisite: 20.351.

21.353 Industrial Instrumentation. Modern methods of measurement and control of the more common process variables, such as temperature, pressure, liquid level, and fluid flow. Servo systems, and computer applications. One session per week, 3 credits. Prerequisites: 17.127, 99.143.

21.361 Cost Control Systems. The fundamentals of basic accounting practice applied to manufacturing organizations. Cost accounting, standard cost and budget control systems. One session per week, 3 credits.

21.372 Operations Research. The use of mathematical models to optimize industrial operations. Game and queuing theories plus linear and dynamic programming are used to provide solutions to industrial problems such as space allocations, scheduling, inventory control and general business strategy. One session per week, 3 credits. Prerequisites: 20.476, 90.232.

21.374 Production Management. Principles of organizational structure, plant location and layout, materials handling, product development, cost reduction programs and modern management techniques. One session per week, 3 credits. Prerequisites: 69.201, 21.452, 21.471.

21.381. Organization Design and Control. Design and control of an industrial organization considering such phases as growth, communication, feedback and motivation. One session per week, 3 credits. Prerequisites: 69.201.

21.382. Manufacturing Cost Analysis. Advanced cost accounting and standard cost systems to be used in the development of financial management decision-making techniques. One session per week, 3 credits. Prerequisite: 21.361.

21.452. Inventory Control and Automatic Warehousing. Design requirements and instrumentation required for automatic warehousing systems together with computer techniques used for stock retrieval, updating inventory, considering lead time and stochastic demands. One session per week, 3 credits. Prerequisite: 21.353.

21.463. Manufacturing Policy. Case studies in manufacturing policy decision making; formulation of plans for staffing; directing and controlling product line manpower, materials, facilities and dollars; justification of policy decision and alternate courses of action; study of the interdepartmental relationship of various manufacturing disciplines and their organizational structure. One session per week, 3 credits.

21.465 Occupational Safety and Health. A study of (1) the impact of employee safety and health on operating costs and (2) the Occupational Safety and Health Act - Public Law 91-596. Rights and responsibilites of employers and employees, management's role, safety committees, safety programs, technical standards, administrative regulations, enforcement procedures, appeal process, economic considerations and cost-benefit analyses. One session per week, 3 credits.

21.471 Production Planning and Tool Development. Selection and design of machine tools to economically adapt these tools to specific manufacturing operations. One session per week, 3 credits. Prerequisites: 21.254, 23.201.

21.484 Proposal Writing. The various fundamentals and formats of proposal writing together with an analysis of the features of sample proposals which suceeded or failed to culminate in the award of contracts. One session per week, 3 credits. Prerequisite: 42.112.

21.492. Production Analysis. The use of mathematical methods in the design and analysis of production systems. Use of computers for production planning, scheduling, and inventory problem solutions. One session per wek, 3 credits. Prerequisites: 21.256, 21.372, 21.374.

MECHANICAL ENGINEERING TECHNOLOGY

23.111 Engineering Drawing I. Class and laboratory. An introduction to graphical communication. Lectures and exercises on the presentation of data and shape description of mechanical solids. Topics include rectangular graphs; log and semilog graphs; charts; orthographic projection; isometric and oblique pictorials; sketching. One session per week, 3 credits.

23.112 Engineering Drawing II. Class and laboratory. Descriptive geometry of lines, points, and planes. Intersections; developments; dimensioning. One session per week, 3 credits. Prerequisite: 23.111.

23.113 Machine Drawing. Class and laboratory. Drawing of a machine from layout through details to final assembly, including drawing of cams, gears, fasteners, welding, and piping. Positional and geometric tolerancing. One session per week, 3 credits. Prerequisites: 23.112.

23.151 Engineering Technology Computations. An examination of the methods used for numerical solutions of technical problems. The problems studied will be selected from those which appear frequently, and do not require solution by computer. Topics include electronic calculators, calculator programs, alignment charts, nomographs, graphical and semi-graphical integration and differentiation, exponential graphs and empirical equations. One session per week, 3 credits. Prerequisites: 90.132, (may be taken concurrently); 23.111.

23.201 Mechanical Technology Laboratory I. (Machine Tool). Modern methods of manufacturing, production, inspection, and measurements of metals and metal fabrications. One session per week, 3 credits.

23.202 Mechanical Technology Laboratory II. (Thermal Fluids). Fundamentals of engineering measurements, flow measurement of steam and air, tests of steam turbines and internal-combustion engines, experimental work with refrigeration units, measurements of heat transfer, combustion, fluid flow, and performance of pumps. One session per week, 3 credits. Prerequisites: 23.243, (may be taken concurrently); 23.242.

23.221 Applied Mechanics I. (Statics). The fundamentals of statics, including such topics as force systems, resultants, equilibrium, friction, first moments of masses and areas. One session per week, 3 credits. Prerequisites: 90.131, 95.141.

23.222. Applied Mechanics II (Dynamics). Laws of kinematics of particles and rigid bodies involving absolute and relative motion. Newton's laws as applied to the kinetics rigid bodies in motion. Principles of work and energy; impulse and momentum. One session per week, 3 credits. Prerequisites: 90.132, 23.221.

23.223 Strength of Materials. Principles of strength of materials, centric, torsional, and flexural loading, principal stresses, Mohr's stress circle, strain, temperature effects, shear and moment diagrams. One session per week, 3 credits. Prerequisites: 90.132, 23.221.

23.231 Mechanisms. Class and laboratory. The principles of kinematics. Topics covered are rolling cylinders and cones, gearing, gear train design, epicyclic gear train design, flexible connectors including stepped pulley and cone design, cam design, linkages, velocity and acceleration diagrams and miscellaneous mechanisms. One session per week, 3 credits. Prerequisite: 99.142.

23.232 Machine Design. Class and laboratory. Application of theories of failure and mechanics of materials to the analysis and design of typical machine elements such as shafts, springs, screws, belts, pulleys, keys, and gears. Problems assigned also illustrate synthesis of ideas applied to design. One session per week, 3 credits. Prequisite: 23.223.

23.241 Elements of Thermodynamics I. The thermodynamic system; heat, work; the first and second laws. Properties of vapors and gases. Perfect gas laws. The use of tables and charts. One session per week, 3 credits. Prerequisites: 90.132, 99.143.

23.242 Applied Fluid Mechanics. Properties of fluids, statics of fluids, fluid flow kinematics, momentum, energy conversion, viscosity, flow of real fluids in pipes,ducts and channels, compressible flow. Fluid couplings and torque converters. Flow measurement and fluid machinery. One session per week, 3 credits. Prerequisite: 23.222.

23.243. Elements of Thermodynamics II. The application of thermodynamic principles. Vapor and gas cycles, refrigeration, energy conversion machinery, mixtures, availability and irreversibility. One session per week, 3 credits. Prerequisites: 23.241.

23.303 Mechanical Technology Laboratory III. (Materials). Experimental study of heat treating of metals, metallography, fatigue and creep. Limitations of the formulas derived in Strength of Materials are investigated through laboratory projects. One session per week, 3 credits. Prerequisites: 23.223, 23.352.

23.352 Properties of Materials I. The mechanical, electrical, thermal, chemical and magnetic properties of engineering materials and how these properties depend on crystal structure and atomic arrangement. Methods of altering the structure of materials to obtain desired properties. One session per week, 3 credits. Prerequisite: 84.121.

23.353 Instrumentation Systems. Class and laboratory. The study of electrical measurements of mechanical quantities through basic measurement theory and physical principles of transducers, frequency analysis, interference and noise, and instrument selection together with force displacement, temperature, fluid flow, velocity, acceleration, pressure and torque phenomena. Laboratory sessions to include vibration analysis, accelerometer calibration and force measurements. One session per week, 3 credits. Prerequisites: 17.128, 23.242.

23.354 Problems in Mechanical Engineering Technology. Class and laboratory. A review and extension of applied mechanics. Assigned problems in statics, dynamics, strength of materials and machine design. Introduction to digital computer programming. One session per week, 3 credits. Prerequisites: 23.222, 23.223.

23.404 Mechanical Technology Laboratory IV. (Manufacturing). Class and laboratory experience with tape controlled machine tools. Topics include basic drawings, linear and circular interpolations for two and more axis machines including the lathe. Writing and preparing manuscript and tape for machine control on both the absolute and incremental system. (It is recommended that this subject be taken during the Fall semester of the student's last year so that preliminary activities associated with 23.405 - Project Lab generally taken during Spring semester of final year - can be incorporated). One session per week, 3 credits. Prerequisites: 90.115, 23.112.

23.405 Mechanical Technology Laboratory V. (Project). The application of the student's engineering training to a practical engineering problem. Engineering experience is gained through planning, executing, and reporting on a project approved by staff advisor. Work may be individual or team effort, depending upon degree of complexity of project. One session per week, 3 credits. Prerequisite: 23.404.

23.455 Thermodynamics and Heat Transfer. An investigation of the basic laws of thermodynamics with primary emphasis on heat transfer by conduction, radiation, and convection. Also considered will be the heat transfer problems associated with microelectronics and other high density electronic packaging operations. One sesssion per week, 3 credits. Prerequisites: 90.132, 99.142.

23.471 Advanced Strength of Materials. Various topics include shear center, unsymmetrical bending, energy methods, unit dummy load method, failure theories. One session per week, 3 credits. Prerequisites: 90.232, 23.223.

23.472 Applied Dynamics. Statics and dynamics as applied to general systems with oscillatory motion. The kinematics of periodic motion and the vibrations of systems with single degree of freedom. One session per week, 3 credits. Prerequisites: 92.314, 23.222, 23.223.

23.473 Machine Design II. Class and laboratory. Advanced problems in design of machine elements. One session per week, 3 credits. Prerequisite: 23.232.

23.474 Properties of Materials II. Class and laboratory. A more detailed study of certain phases of engineering materials covered in 23.352 which are of particular interest to the mechanical engineer such as fatigue, creep, and material section. One session per week, 3 credits. Prerequisite: 23.352.

23.475 Heat Transfer. Class and laboratory. Theory and application of heat conduction in solids. Radiation of heat and application to problems arising in practice. One session per week, 3 credits. Prerequisites: 92.314, 23.243, 23.242.

23.476 Non-Destructive Testing. Class and laboratory. The non-destructive evaluation of materials and processes by sonic, magnetic, thermal, and electrical radiations. One session per week, 3 credits. Prerequisites: 90.232, 99.143.

23.477 Experimental Stress Analysis. Class and laboratory. The determination of stresses in complex structures by experimental techniques. Photoelasticity, birefringent coatings, brittle lacquer method, analogies, and mechanical and electrical resistance strain gages. One session per week, 3 credits. Prerequisites: 90.232, 23.223.

INDUSTRIAL TECHNOLOGY

20.107 Introduction to Engineering Design. A course to introduce students to industrial practice in design graphics. Topics include graphs, orthographic projection, sectioning, limit dimensioning, gear trains, cams and fasteners. A mechanical design problem completes the semester's work. One session per week, 3 credits.

20.109 Engineering Design Laboratory. A laboratory course to provide the practical experience and application of the theory and techniques of 20.107 to actual industrial design case studies. One session per week, 3 credits. Corequisite: 20.107.

20.121 Hydraulics for Plant Operators. Topics include fluid properties, pressure, flow through pipes, fittings and channels, flow measuring instruments, pumping. One session per week, 3 credits.

20.201 Structure of Metals. A practical study of the structure of metals and methods used to improve their properties for industrial applications. This course includes selection, heat treatment and fabrication of metals as well as their preparation and applications for use under extreme environmental conditions. One session per week, 3 credits.

20.221 Wastewater Treatment Plant Operations I. Course is geared to the assumption that students are not familiar with plant operations. Lectures begin on preliminary treatment and proceed through primary and various types of secondary treatment with emphasis on activated sludge, chlorination, and sludge dewatering and ultimate disposal. The primary emphasis is on the conventional activated sludge process. One session per week, 3 credits.

20.222 Wastewater Treatment Plant Operations II. This course is available for those who have taken 20.221, or for plant operators experienced in biological treatment. Control of the activated sludge process is emphasized, based upon solids balancing, using the centrifuge and settleometer. This technique has been developed by Al West of EPA. In addition, industrial wastes and advanced wastewater treatment are covered, including the removal of phosphates and nitrates. One session per week, 3 credits. Prerequisites: 20.221.

20.223 Wastewater Treatment Lab. I. An introductory course teaching the basic laboratory techniques and procedures used to operate and monitor conventional wastewater treatment facilities. Included are solids, chlorine residual, pH, BOD, total coliform, alkalinity, acidity, sludge, and microscope analysis. One session per week, 3 credits. Corequisite: 20.221.

20.224 Wastewater Treatment Lab II. An advanced course designed to teach the lab techniques and procedures used to operate and monitor advanced wastewater treatment facilities. Included are "West" method, nitrification, phosphorous, jar test, COD, BOD, TOC, total coliform, turbidity, and chloride analysis. One session per week, 3 credits. Prerequisites: 20.221, 20.223.

20.225 Water Chemistry. A practical introduction to the chemistry of natural waters, emphasizing chemical equilibria. Topics also include basic concepts of chemistry, solution computations, water quality criteria, water analyses, and conventional water treatment processes. One session per week, 3 credits.

20.226 Water Treatment Operations. Operation and control of municipal and industrial water treatment processes including coagulation, flocculation, sedementation, filtration,softening, adsorption, ion exchange, disinfection, corrosion control and membrane processes, pumping chemical feed, and control systems. One session per week, 3 credits. Prerequisite: 20.225.

20.301 Modern Materials. This course is a continuation of the study of materials. It covers the third general classification of engineering materials, ceramics, and the structural potpourri of all engineering materials, composites. The study of ceramics will stress the way these properties enter into the selection of ceramic materials for industrial applications. The study of composites will serve as a review of all joining processes used in manfacturing. One session per week, 3 credits. Prerequisite: 20.201

20.306 Seminar I. A seminar course of industrial technology juniors actively pursuing an industrial internship program. One session per week, 3 credits.

20.307 Fluid Power Controls. Laboratory experiences and lectures on the elements of hydraulic and pneumatic power systems, and the automatic control of these systems. Systems elements studied are actuators, valves, power sources and accessories. Control systems studied are pneumatic, electronic and fluidic logic. Electrical solenoid and relay control circuits are designed. One session per week, 3 credits.

20.311 Modern Manufacturing Processes. Students participating in this course will gain both a theoretical and a practical understanding of modern manufacturing processes. These include numerical control machining, preparation of N.C. Tapes, electric discharge machines, casting, fastening methods, and assembly techniques. Product design as related to manufacturing will be considered. One session per week, 3 credits. Prerequisite: 23.201.

20.351 Method-Time Analysis. Methods improvement and work measurement techniques, including principles of motion economy, work simplification, process and operator charts, work sampling and time standards. One session per week, 3 credits.

20.402 Manufacturing Operations. This course is organized so that students can design the manufacturing process and fabricate a product for small quantity production. Accompanying lectures cover pertinent subject areas such as: forecasting, plant layout, materials handling, pert/cost, product evaluation and equipment selection. Several plant trips and outside speakers are usually scheduled. One session per week, 3 credits. Prerequisites: 23.231, 17.127.

20.403 Seminar II. A seminar course for I-T seniors actively pursuing an industrial internship program. One session per week, 3 credits.

20.406 Seminar III. A seminar course for I-T seniors actively pursuing an industrial internship program. One session per week, 3 credits.

20.408 Instrumentation & Process Control. An introduction to process control system technology. Liquid level, rate of flow, pressure and temperature measuring devices and their characteristics. R-C of system components. Integral, dead-time and first order lag processes. Control modes. Bode diagrams and frequency response. One session per week, 3 credits. Prerequisite: 17.127.

20.410 Instrumentation and Process Control Laboratory. A laboratory course to supplement the theory studied in 20.408. Various mechanisms used in industrial processes and their controls will be assembled and varied to accomplish the task required by practical problems. Equipment will also be built to automated control of processes. One session per week, 3 credits. Corequisite: 20.408.

20.414 Industrial Economic Management. Analysis of available alternatives in equipment, plant and materials purchasing or leasing. Economic feasibility analysis of industrial projects including depreciation techniques, breakeven analysis, benefit-cost techniques, replacement, present worth and rate of return analysis. One session per week, 3 credits.

20.476 Statistical Quality Control. A study of the statistical and adminstrative techniques relative to the maintenance of product quality at defined levels. Sampling plans for variables and attributes are considered from the viewpoint of consumer-vendor relationships and economics. One session per week, 3 credits. Prerequisite: 92.383.

PLASTICS

27.201 Plastics Materials Science. Class and laboratory. The history, classification, definitions, raw materials, methods of manufacture, properties and uses of polymeric materials with emphasis on the engineering plastics. Laboratory sessions and demonstrations as scheduled by the instructor. One session per week, 3 credits.

27.202 Plastics Materials Science. Class and laboratory. A continuation of 27.201 with special emphasis on fillers and reinforcements, modifiers, additives and other ingredients that go into making typical plastics molding compounds. Introduction to laminates and reinforced plastics, film and sheeting, as well as adhesives, and miscellaneous resins are surveyed. Laboratory sessions and demonstrations as scheduled by the instructor. One session per week, 3 credits. Prerequisite: 27.201.

27.301 Additives for Polymeric Materials. Analysis of additives including stabilizers, plasticizers, fillers and reinforcements, biocides, flame retardants, antistatic agents, and release agents. Special emphasis on the characteristics of each type of additive, compatibility interactions, and effects on processing. Review of the most current methods of testing efficiency of each additive system. One session per week, 3 credits.

27.373 Plastics Mold Engineering I. Class and laboratory. Introduction to the principles of basic mold and die design and construction. Laboratory design of molds and/or dies to be constructed in continuing portions of this course. Lecture, laboratory and demonstrations at the discretion of the instructor. One session per week, 3 credits. Prerequisite: 27.401.

27.376 Mold Engineering II. (Continuation of 27.373 which is a prerequisite.) One session per week, 3 credits.

27.401 Processing Technology I. Class and laboratory. Theory and methods of processing plastics materials including compounding, molding, extruding and thermoforming. Evaluation and development of typical problems. Laboratory sessions and demonstrations as scheduled by the instructor. One session per week, 3 credits. Prerequisite: 27.202.

27.402 Processing Technology II. Class and laboratory. A continuation of 27.401 which touches extensively upon casting, laminating, fabricating, and finishing. Correlation of composition, processing and fabricating with product design and applications is also covered. Laboratory sessions and demonstrations as scheduled by the instructor. One session per week, 3 credits. Prerequisite: 27.401.

27.405 Polymer Characterization. Instrumental methods of characterizing plastics materials. The theory and interpretation of infrared spectroscopy, gas chromatography, gel permeation chromatography, differential thermal analysis, thermal gravimetric analysis, osmometry, etc. The determinations will include elucidation of structure, indentification, molecular weight, molecular weight distribution and glass transition temperatures. One session per week, 3 credits. Prerequisite: 84.126, permission of instructor.

27.451. Selected Topics in Polymers I Specialized topics in applied polymer science, adhesives, elastomers, coatings, and fibers as well as other timely subjects. One session per week, 3 credits. Prerequisite: permission of instructor.

27.452 Selected Topics in Polymers II. (Continuation of 27.451 which is a prerequisite, also permission of the instructor). One session per week, 3 credits.

CLINICAL LABORATORY SCIENCES

35.101 Anatomy & Physiology I. An introduction to the study of the human organism relating structure and function. Among the topics treated are cytology, histology, the skeletal system, the muscular system, the nervous system and circulatory system. The course is designed to provide students with a working knowledge of human anatomy and physiology through an understanding of the fundamental principles involved in the structures and functions of the body, through interrelationships and through feedback mechanisms. Clinical applications will be presented. One session per week, 3 credits. Corequisite: 35.103.

35.102 Anatomy & Physiology II. A continuation of the study of the human organism relating structure and function. Among the topics treated are the circulatory, respiratory, digestive, excretory, endocrine and reproductive systems of man. The course is designed to provide students with a working knowledge of human anatomy and physiology through an understanding of the fundamental principles involved in the structures and functions of the body, through interrelationships and through feedback mechanisms. Clinical applications will be presented. One session per week, 3 credits. Prerequisites: 35.101; 35.103. Corequisite: 35.104.

35.103 Anatomy and Physiology Laboratory I. The laboratories are designed to reinforce didactic material by practical exposure to the subject matter. A second major outcome will be an understanding of laboratory methodology-—viz. a thoughtful approach to problems, precise procedures and an appreciation of variables. One session per week, 3 hours, 1 credit. Corequisite: 35.101.

35.104 Anatomy & Physiology Laboratory II. The laboratories are designed to reinforce didactic material by practical exposure to the subject matter. A second major outcome will be an understanding of laboratory methodology-—viz. a thoughtful approach to problems, precise procedures and an appreciation of variables. One session per week, 3 hours, 1 credit. Prerequisites: 35.101; 35.103. Corequisite: 35.102.

35.211 Basic Clinical Microbiology and Pathology. The course is designed to study the fundamentals of microbiology with major emphasis on the structure and function, growth and metabolism and classification of clinically important microorganisms; the origin and mechanism by which microorganisms produce disease; the human body's response to invading microbes; an introduction to the ecological aspects of microorganisms in the environment with particular stress on their significance, activites (beneficial and detrimental) and control measures. One session per week, 3 credits. Prerequisites: 35.101; 35.102; 35.103; 35.104. Corequisite: 35.213.

35.213 Basic Clincial Microbiology and Pathology Laboratory. Laboratory investigations of basic properties and characteristics of microorganisms; the student will perform commonly used techniques for collecting, handling and studying clinically important microorganisms. One session per week, 3 hours, 1 credit. Prerequisite: 35.101; 35.102; 35.103; 35.104. Corequisite: 35.211.

35.251 Physiological Science I. An amplification of the principles of physiology important to a thorough understanding of the function and pathology of the human organism. Nuclear medicine will be discussed with major emphasis on diagnostic and therapeutic applications. Fluid balance, dehydration and mineral metabolism will be covered with a look at selected inorganic species and their roles in normal and pathologic states of health. Oxygen, basal metabolism and biological oxidation will be discussed in depth. The process of respiration will be covered in detail, including oxygen and carbon dioxide transport, buffering systems, acidosis, alkalosis and compensation mechanisms. The role of enzymes as biochemical catalysts will be discussed along with their clinical significance in enzymic defect diseases. Lipids will be considered, including their significance in normal and pathologic states and their metabolic significance. One session per week, 3 credits. Prerequisites: 35101; 35.102; 35.103; 35.104. Corequisite: 35.253.

35.252 Physiological Science II. A continuation of 35.251. Carbohydrates, proteins, purines, pyrimidines and their matabolic cycles will be considered in depth with a study of selected diseases and/or pathological conditions resulting from abnormalities in the cycles. The major hormones controlling metabolism will be studied including the interrelationships of the secreting glands and the target organs. The digestive process and absorption and excretion from the gastrointestinal tract will be discussed. the role of vitamins in nutrition will be surveyed. Blood, lymphatic and cerebrospinal fluid will be studied with emphasis placed on their use as clinical indicators of body function. Kidney and liver function and testing will be explored along with the formation and clinical significance of porphyrins and bile pigments. Selected bio-chemical aspects of the tissues will be presented. One session per week, 3 credits. Prerequisite: 35.251. Corequisite: 35.254.

35.253 Physiological Science Laboratory I. The properties of solutions, colloids, osmosis, dialysis, ionization, pH and buffers will be studied. The role of essential elements in living systems and the action of toxic species will be evaluated. The use of chromatography as a clinical tool will be illustrated. Basic quantitative skills will be developed, including a study of the laws of photometry. Major emphasis will be on body fluid analysis. One session per week, 3 hours, 1 credit. Prerequisites: 35.101; 35.102; 35.103; 35.104. Corequisite: 35.251.

35.254 Physiological Science Laboratory II. The properties of the basic biochemical substances will be studied. Compound lipids will be isolated; carbohydrates, proteins and enzymes will be examined along with their roles in normal and abnormal physiology. RNA will be isolated and its chemical composition determined. Qualitative and semi-qualitative analysis will be carried out on normal, pathological blood samples and urinary calculi. Extensive kidney and liver function testing will be performed along with quantitative analysis of selected serum constituents such as amylase, lipase, and salicylates. One session per week, 3 hours, 1 credit. Prerequisites: 35.251; 35.253. Corequisite: 35.252.

MEDICAL TECHNOLOGY

36.311 Clinical Microbiology I. A study of the cultural, biochemical, serological and pathogenic characteristics of disease microorganisms. Emphasis will be placed on the pathophysiology of the infectious diseases and its relationship to isolation and identification of the pathogenic microorganisms. One session per week, 3 credits. Prerequisites: 35.211; 35.213.

36.313 Clinical Microbiology Laboratory I. Emphasis will be placed on the identification of pathogenic microorganisms and differentiation of them from closely related species which represent man's indigenous flora. One session per week, 4 hours, 2 credits. Prerequisites: 35.211; 35.213. Corequisite: 35.311.

36.321 Clinical Hematology I. A study of the human hematopoietic system and its relationship to other organ systems. Discussions will included morphological and biochemical relationship of erythropoiesis and leukopoiesis in health and disease states. A study of the mechanics and relationship of blood coagulation as it pertains to health and disease states will also be included. One session per week, 3 credits. Prerequisites: 35.101; 35.102; 35.251; 35.252. Corequisite: 36.323.

36.323 Clinical Hematology Laboratory I. Emphasis will be placed on current hematologic tests and coagulations used in today's clinical laboratory. In addition, the clinical implications of these tests to diagnose, monitor and evaluate various health and diseased processes will be discussed. One session per week, 4 hours, 2 credits. Corequisite: 36.321.

36.341 Fundamentals of Clinical Chemistry. A study of the principles that govern the properties, reactions, methods of preparation, isolation and identification of organic compounds. A study of the major classes of compounds of the group IV, V, and VI, elements of the periodic table. One session per week, 3 credits. Prerequisites: 35.251, 35.252. Corequisite: 36.343.

36.343 Fundamentals of Clinical Chemistry Laboratory. Laboratory consists of organic synthesis, separation of mixtures according to solubility and functional groups and identification by crystallization, through layer chromatography, gas phase chromatography and identification of compounds on the basis of physical properties including spectra. One session per week, 4 hours, 2 credits. Prerequisites: 35.253, 35.254. Corequisite: 36.341.

36.350 Human Biochemistry. An in depth study of biochemical substances and their reactions in the human body. Emphasis will be placed on metabolism of cells, tissues and organs. Those biochemical processes which underlie pathological conditions will be emphasized. One session per week, 3 credits. Prerequisites: 35.251; 35.252; 36.341; 36,343.

36.351 Clinical Biochemistry I. A detailed study of the specific biochemical substances in the human body which are of clinical significance. Normal and abnormal constituents will be considered, along with the variables which affect their presence and concentrations in the human organism. Prerequisites: 35.215, 35.252, 36.341, 36.343. Corequisites: 36.353, 36.350.

36.353 Clinical Biochemistry Laboratory I. This course is intended to instruct the student in the analytical procedures and the methods currently used in clinical laboratories. Emphasis will be placed on blood and urine analysis, including enzyme activity. Methods of instrumentation, calibration and quality control will be emphasized. Prerequisites: 35.251; 35.252; 36.341; 36.343. Corequisite: 36.351.

36.361 Medical Instrumentation. Course will include an introduction to basic electricity and electronic circuitry along with the use of measurement devices such as the VTVM and the oscilloscope. The applications of digital electronics and operational amplifiers in clinical instrumentation will be illustrated. The components of spectrophotometers, servo devices, electrometric equipment and radiation instrumentation will be discussed with major emphasis placed on the mechanism of operation, electrical, mechanical and optical considerations, signal amplification characteristics and preventative maintenance and troubleshooting. One session per week, 3 credits. Prerequisites: 35.251; 35.252.

36.363 Medical Instrumentation Laboratory I. Student will perform experiments in basic AC-DC electricity, electronic circuitry and digital electronics. The electrical, mechanical and optical characteristics of common clinical laboratory instruments will be studied in depth. Students will be expected to become proficient in preventative maintenance and minor troubleshooting of instrumentation. One session per week, 4 hours, 2 credits. Corequisite: 36.361.

36.420 Clinical Hematology Practicum. Supervised clinical training in a consortial hospital clinical laboratory. Designed to reinforce knowledge and skills gained in lecture and laboratory and at the same time introduce the student to the daily activities of a clinical hematology laboratory. Emphasis will be placed on quality control, methodology and clinical interpretation. One session per week, 6 hours, 4 credits. Prerequisites: 36.321; 36.323.

NURSING

30.202 Community Health. Emphasizes the concepts, philosophy and principles of public health and the relationship to the physical, mental and social well-being of the community, its individuals, families and groups. The focus is on the prevention of disease, the promotion and maintenance of health and the provision of environmental and personal health services through organized community effort.

33.202 Basic Principles for Nursing Practice. This course introduces the student to the basic principles of nursing. Lecture and laboratory methods will be utilized to develop basic perceptual motor and communication skills. Nursing principles will be applied in simulated or clinical experiences. Members of the Department.

33.301 Nursing Science I: Lecture. The students are introduced to the profession of nursing, its practice, its role, its legal responsibilities and its relationships with other health disciplines. The nursing process is taught as a model for delivery of professional nursing care, with emphasis on the phase of assessment. An overview of wellness throughout the life cycle is presented. Prerequisites: 33.202 and completion of mandatory core program. Members of the Department.

33.302 Nursing Science I: Basic Clinical Module. Each student spends two days a week for one-half semester in a medical-surgical setting in order to develop nursing skills. The student assesses the patient's position on the health-illness continuum. Under faculty guidance, the student interviews selected patients and develops a plan to meet the identified health needs. Implementation and evaluation of this nursing care plan is carried out according to the student's level of development. Members of the Deaprtment.

33.303 Nursing Science I: Maternal Child Health Clinical Module. For the purpose of assessing health care needs and planning nursing care, each student spends two days a week for one-half semester with well children and families in a variety of settings. Members of the Department.

33.304 Nursing Science I: Psychosocial Assessment. The course includes identification and exploration of the behavioral concepts that underlie the practice of professional nursing. Emphasis is on developing the student's skill in interviewing techniques and psychosocial assessment methods. Application of the concept of the therapeutic use of the self is facilitated through analysis of student-client interactions. Members of the Department.

33.305 Nursing Science I: History Physical Assessment Lecture. A systems-oriented introduction to history-taking and physical assesments. Concepts will be presented in a weekly one-hour didactic session jointly taught by a physician and nurse practitioner. Members of the Department.

33.306 Nursing Science I: History Physical Assessment Laboratory. Supervised laboratory practice sessions offer students opportunity to apply theory presented in 33.305 and to develop related technical skills. Members of the Department.

33.307 Nursing Science I: Seminar. Seminar provides the student with the opportunity to apply leadership skills, to share knowledge through participation, and to investigate in-depth an area of special interest. Members of the Department.

33.310 Nursing Science II: Medical/Surgical/Psychiatric Nursing Clinical Module. Students are guided through learnings which are designed to increase clinical, interpersonal competencies, and professional growth. Experiences with hospitalized patients are selected for application of theoretical concepts. Psychosocial aspects of patient care are integrated in the plan of care for hospitalized patients and their families. The planning phase of the nursing process is emphasized. Members of the Department.

33.311 Nursing Science II: Maternal Child Health/Community Clinical Module. Students work with clients in obstetric and pediatric units, utilizing relevent theory in applying the planning phase of the nursing process. Visits to families in the child-bearing and child-rearing phase provide opportunities to observe the dynamics of family behavior and to make appropriate referrals. Members of the Department.

33.312 Nursing Science II: Psychosocial Assessment. Students continue to expand upon interpersonal techniques and psychosocial assessment skills. Emphasis is on developing the student's ability to form hypotheses about behavior and to develop a plan for nursing intervention which incorporates relevant theoretical concepts and research findings, as well as approriate treatment modalities. Members of the Department.

33.313 Nursing Science II: History/Physical Assessment Lecture. A systems-oriented course in history-taking and physical assessment, focusing on assessment of the young in accordance with curricular emphasis. Concepts will be presented in a weekly one-hour session via lectures, films, and other audiovisual resources. Jointly taught by a nurse practitioner and physician. Members of the Department.

33.314 Nursing Science II: History/Physical Assessment Laboratory. Supervised laboratory sessions for developing physical examination skills with the application of theoretical concepts from lectures and readings. Members of the Department.

33.401 Nursing Science III: Lecture. Continued study of the unidirectional growth pattern with emphasis on common medical and surgical problems affecting adults between the ages of forty and senescence. Normal physiological and psychosocial changes in the maturing process are studied along with changes of a pathological nature. Concepts of crisis prevention and intervention, fluid and electrolyte balance, legal aspects, safety and security needs, teaching, rehabilitation, consultation and collaboration are applied in planning nursing intervention for patients in primary, acute and long-term settings. Prerequisites: Completion of Junior level nursing courses. Members of the Department.

33.402 Nursing Science III: Seminar. Faculty selects seminar topics pertinent to Nursing Science III. The student assumes responsibility for assessing the learning needs of peers in relation to the topic to be presented and for promoting learning through group analysis and discussion. Members of the Department.

33.403 Nursing Science III: Clinical Laboratory. Application of concepts and skills learned in previous nursing courses and nursing theory. The total nursing process is developed as students provide care to adults with common medical/surgical conditions in a variety of acute care settings. Mastery of physical assessment and other advanced nursing skills are developed. The clinical experience integrates multiple concepts such as aging, health promotion, rehabilitation, nutrition, pharmacodynamics and the teaching and research role of the nurse. The student participates in the selection of his own learning experiences based on his individual learning needs. Members of the Department.

33.404 Nursing Science III: Community Laboratory. Application of community and mental health principles is emphasized in this component of the course. The focus is on recognition of common health problems in community settings. Clinical placements stress long-term care in both the hospital and home. Members of the Department.

33.405 Nursing Science III. Clinical History/Physical Exam Recitation. This course offers increased depth of understanding in physical assessment. Topics will coordinate with the weekly content presented in 33.401. Periodic practicums will be arranged on an assigned basis in the community or in the physical assessment laboratory utilizing clients in the older adult age category in accordance with curricular emphasis. Corequisite: 33.401. Members of the Department.

33.406 Nursing Science IV: Lecture. Emphasis evaluation as a continuous part of decision making in the nursing process. Examines critically the trends, methods, problems and legal implications of nursing care. Integrates (with an elementary research project) theories relating to initiation and promotion of change. Utilizing prior knowledge of the health needs of patients from 40 to senescence, the student prepares for advanced nursing practice, including team leadership. By synthesizing health assessment knowledge and skills in history-taking and physical examination and by communicating effectively with multidisiplinary team members, the student coordinates planned intervention for patient health maintenance and rehabilitation and prepares to be a self-directing professional nurse. Prerequisites: All Nursing Science I courses. Members of the Department.

33.407 Nursing Science IV: Seminar. Seminar method is used to focus on student selected topics relating to nursing practice. Leadership skills including interpersonal relationships, group process, and evaluation will be emphasized. Concepts relating to professional issues are analyzed to stress future trends in nursing. Members of the Department.

33.408 Nursing Science IV: A.V. Simulation Laboratory. Faculty selected films, filmstrips, slides and tapes reinforce student learning in the audiovisual laboratory. This independent learning fosters understanding of health problems encountered in hospital and community settings. Members of the Department.

33.409 Nursing Science IV: Clinical Hospital Laboratory II. Clinical learning experiences provide the student with opportunities to synthesize, integrate and apply knowledge of human development and needs while caring for critically ill individuals and/or groups of individuals. The student begins to function as a team leader. All aspects of the professional nursing role are stressed including interdisplinary cooperation, patient advocacy, teaching and accountability through self initiated evaluation of performance. The student will utilize current research and investigate problems requiring change within the clinical situation. Members of the Department.

33.410 Nursing Science IV: Community Laboratory. The student functions with greater independence in assessing a health need of an individual, family or group in a variety of community settings. Beginning research skills are applied to identify pertinent community and mental health aspects of the problem. A plan is formulated, based on investigative findings, and recommendations are made for appropriate nursing intervention. Members of the Department.

33.411 Nursing Science IV: Clinical History/Physical Exam and Practicum. This course concludes the four semester course on history-taking and physical assessment. Building on the skills and theory of physical assessment and all other nursing courses, this class will cover selected topics dealing with integration of expanded skills into current nursing practice. Learner identified areas of interest will be presented by small groups to class with the assistance of the instructor and outside consultants. Practicums will be conducted with patients from a variety of age ranges in community and acute-care agencies. Members of the Department.

CRIMINAL JUSTICE

44.101 The Criminal Justice System. A survey of the Criminal Justice System. The course includes a brief history of the Criminal Justice system and an analysis of its structures and function. One session per week, 3 credits.

44.131 Principles of Law and the Legal System. An introduction to the legal system, including the legal structure, criminal law, constitutional law, and individual rights. One session per week, 3 credits.

44.141 Police Functions: Theory and Application. An examination of the historical development of policing, with special emphasis on the conflicting role expectations facing the police officer. One session per week, 3 credits.

44.151 Introduction to Corrections I. A comprehensive of theory, practice and philosophy involved in the treatment of convicted law violators of all ages. One session per week, 3 credits.

44.152 Introductions to Corrections II. An examination of the role of correction in the total process of adjudication, with emphasis on the history of correctional practices and the evolution of the rehabilitative philosophy. One session per week, 3 credits.

44.161 Juvenile Delinquency. Proposed causative factors in the development of youthful offenders will be examined. The development and philosophy behind treatment of juveniles - such as status offenses. The juvenile court and clinic, and training schools, as well as contemporary innovative practices - will be covered. One session per week, 3 credits.

44.221 Criminology I. The definition and nature of crime, criminal statistics, and a survey of approaches to theories of crime causation will be included. One session per week, 3 credits.

44.222 Criminology II. An examination of key theories of criminal behavior, both historical and contemporary, and their impact on the evolution of punishment, treatment and rehabilitative practices. One session per week, 3 credits.

44.231 Juvenile Court Philosophy and Practice. Examinations of the civil procedures used in the juvenile court as opposed to the adversary procedures used in criminal court, together with a history of the development of the juvenile court and an examination of the constitutional basis of the juvenile court. One session per week, 3 credits. Prerequisite: 44.161

44.234 Criminal Law. The historical development and origin of criminal law beginning with common law to contemporary decisions and statutes. Constitutional and statutory factors as they pertain to crime, defense and crimes against persons and property will be considered. In addidion, attention is directed toward limitations of criminal responsibility, capacity and the law of arrest. Sections of the Massachusetts Criminal Code and other statutes will be covered where applicable. One session per week, 3 credits.

44.235 Youth and the Law A study of the laws relating to juveniles, including the police rule, intake and detention procedures, diversion, and juvenile court action. One session per week, 3 credits.

44.241 Comparative Police Systems. A study of various police systems on a national and international level and a comparison to localized systems as they relate to the organization, structure, and administration of Law Enforcement Agencies. Agencies in Europe, United Kingdom, Russia, and other parts of the United States will be reviewed. One Session per week, 3 credits.

44.243 Criminalistics I. Principles and procedures regarding arrest, search and seizure and the gathering of evidence and its evaluation regarding admissability, weight, and competence as it pertains to a scientific approach in gathering such evidence. One session per week, 3 credits.

44.244 Criminalistics II. Collection, identification, preservation, and transportation of physical evidence. The crime laboratory and its effectiveness, capability and limitation in assisting the police enforcement officer in examining and utilizing physical evidence as a means of conviction and/or apprehension. One session per week, 3 credits. Prerequisite: 44.243.

44.251 Alternatives to Corrections I. Modern trends in corrections, such as the community based programs in work-release, half-way houses, parole clinics, the therapeutic community and treatment team concept in institutions are described and evaluated. One session per week, 3 credits.

44.252 Alternatives to Corrections II. An extension of Alternatives to Corrections I, with emphasis placed on supervised field work in various correctional agencies and the Courts, periodic conferences, and reports on field assignments. Assigned readings on related topics correlated with field experience will be required. One session per week, 3 credits. Prerequisite: 44.251.

44.253 Problems of Misdemeanants. The problems of correctional programming for the short-term offender will be examined, with special emphasis on alcoholism, prostitution, homeless persons, and related problems. One session per week, 3 credits.

44.254 Probation and Parole I. The historical development of both probation and parole and an examination of their places in the criminal justice system, supplementing the traditional punishments. One session per week, 3 credits.

44.255 Probation and Parole II. Specific emphasis on recent trends, including diversion, flat sentencing, weekend sentencing, and the issues challenging these traditional practices. One session per week, 3 credits. Prerequisite: 44.254.

44.331 Penal Law. A study of the constitutional rights of incarcerated individuals, including privileges of offenders, major policy issues and trends associated with completed and current revisions of penal codes as related to recent court decisions for the preservation of offenders' rights will be covered. One session per week,3 credits.

44.371 Criminal Justice Management and Planning. An introduction to the principles of administration, including planning, budgeting, grantsmanship and evaluation, as they relate to the criminal justice manager. One session per week, 3 credits.

44.372 Issues in Correctional Administration. Specific analysis of the management of correctional institutions, including custody, classification, reception, programming, release, staffing, scheduling, collective bargaining, and other related issues. One session per week. Prerequisite: 44.371.

44.373 Issues in Police Administration. Specific analysis of the management of a contemporary police force, including staffing, scheduling, training, collective bargaining, community relations and other related issues. One session per week, 3 credits. Prerequisite: 44.371.

44.390 Introduction to Criminal Justice Research. An overview of the role of research in the criminal justice system, including terminology, standard methodologies, and elementary statistics. One session per week, 3 credits.

44.401 Seminar on Drugs. The course objective is designed to cover the problems of drugs, drug abuse, the law and its application. Treatment of and alternatives to drug rehabilitation will be studied in addition to the classification, identification, distribution, and control of drugs. One session per week, 3 credits.

44.490 Criminal Justice Research Seminar. Specific practice in the definition, design and execution of a research project, and an analysis of the impact of contemporary criminal justice research on policy development. One session per week, 3 credits.

44.496 Practicum-Field Experience I. Assigned field work under supervision and with permission of Coordinator designed to broaden the educational experience of pre-service students in law enforcement and corrections by providing exposure in selected correctional, law enforcement, probation and parole agencies within the area. This course is designed to provide a correlation of theoretical knowledge with practical experience in an area of particular interest to the student. One session per week, 3 credits.

AREA I: BEHAVORIAL AND SOCIAL SCIENCES

43.105 Western Civilization to 1715. Traces the major forces in the development of European history from the fall of the Roman Empire to 1715. One session per week, 3 credits.

43.106 Western Civilization since 1715. Examines the major forces in the development of modern European history from the French Revolution to the present. One session per week, 3 credits.

43.111 United States History to 1877. Traces the development of American history and institutions from the colonization to the end of Reconstruction. (not open to history concentrators). One session per week, 3 credits.

43.112 United States History since 1877. Examines significant developments in American history from the end of the Reconstruction period to the present. (not open to history concentrators). One session per week, 3 credits.

43.237 American Environmental History. Attitudes, policies and behavior of Americans and their government toward the environment. Special attention to current issues evolving out of our past attitudes and policies. One session per week, 3 credits.

43.277 Ethnic Groups in American Life. An examination of the importance of ethnic groups in American history. The course will treat several major ethnic groups and assimilation or non-assimilation into American life. Field work and research on ethnic groups in the Merrimack Valley. One session per week, 3 credits.

43.304 Recent U.S.History, 1940 to the Present. The involvement of the U.S. in World War II marks a major turning point in American history. It ushers in twenty years of Cold War tensions, the militarization of society and participation in foreign alliances and limited wars. Anti-communist conservatives, militant Blacks and a New Left polarize politics and produce a contemporary crisis of confidence in American society. One session per week, 3 credits.

43.312 Current Latin American Problems. An analysis of significant trends and problems of Latin America, with emphasis on the cultural, economic, political, and social conditions which stimulate or deter progress. One session per week, 3 credits.

43.313 American Social History to 1880. Selected topics in American social history, including mobility and class structure in American life, American religion, ideals of family life and child rearing, race and ethnic groups in American life, myths and reality in American economic life. One session per week, 3 credits.

43.314 American Social History Since 1880. A continuation of the preceeding. One session per week, 3 credits. Prerequisite: 43.313 or permission of the instructor.

43.316 History of Lowell. An examination of the history of industry, politics and the culture of the city of Lowell. Work will be done largely in original sources and a research project is required. One session per week, 3 credits.

43.318 The American Frontier. Readings and discussion of the history of the American society and thought. One session per week, 3 credits.

43.320 Contemporary American Foreign Policy. A study of the process of American foreign policy in the contemporary world. The case study method will be used to illustrate problems of strategy and tactics in such areas as Europe, Latin America, Africa and the Near and Far East. One session per week, 3 credits.

43.324 The Rise of American Industrial Society. Selected topics in the economic history of the United States. Topics include: railroads and the development of a national market, the exploitation of national resources, the rise of new industries, the problems of labor, the consolidation of business, and the problems of agriculture in the new industrial state. One session per week, 3 credits.

46.101 Introduction to American Politics. An introductory analysis of the structures, functions, and behavior of the American political community. The analysis will emphasize politics and political behavior at the national level. One session per week, 3 credits.

46.121 Introduction to International Relations. Survey of some recent methods and approaches used in the study of international politics and the introduction of current problems of foreign policies of major world powers. One session per week, 3 credits.

46.195 Constitutional Law and Civil Liberties. An introductory examination of selected major contemporary civil liberties issues and the American process of constitutional adjudication through a study of Supreme Court decisions and related readings. Emphasis on study, debate, and discussion of the continuing "first amendment" controversies, establishment and free exercise of religion, free speech, free press, obscenity, academic freedom, etc. Attention also to the expansion of procedural guarantees, primarily in the area of criminal justice. One session per week, 3 credits.

46.196 Constitutional Law and Civil Rights. An introductory examination of selected major current civil rights problems and the American process of constitutional adjudication through a study of Supreme Court decisions and related readings. Primary emphasis on study, debate, and discussion of the developing equal protection controversies and the "affirmative" remedies that have arisen from judicial efforts to command equality in areas such as school desegregation, sex discrimination, affirmative action, and legislative reapportionment. Attention also to other developing areas such as privacy, abortion, etc. One session per week, 3 credits.

46.256 American Public Administration. A study of the bureaucratic organization and behavior in the American society. The course covers the Federal Administration in process with a particular emphasis on the problems of bureaucratic authority versus democracy and social change. One session per week, 3 credits.

46.282 Contemporary Political Theory. An examination of major ideological currents in the contemporary world. Marxism, communism, fascism, anarchism, and the relevance of Freud to modern political thought are some of the possible topics for examination. One session per week, 3 credits.

46.344 The American Presidency. An examination of the nature of the American Presidency and its functioning within the American political system. Specific attention will be given to the problems and the evolution of the Presidency since World War I. One session per week, 3 credits.

47.101 General Psychology. A basic introductory course, primarily for non-concentrators, surveying the major areas of psychology, including the nature of psychology as a science, learning, human development and personality, perception and motivation, behavioral disorders, and social behavior. One session per week, 3 credits.

47.163 Developmental Psychology. Primarily for non-concentrators, this course surveys the major stages and processes in human development from birth to death. One session per week, 3 credits.

47.209 Social Psychology. An introduction to the study of social behavior in interpersonal relationships, groups, organizations, and the community. Topics include attitudes and attitude change, group dynamics, leadership, and interpersonal influences. One session per week, 3 credits.

47.232 Theories of Personality. A survey of the major theories of personality, beginning with Freud and psycho-analysis, the neo-Freudians, existential psychology, humanistic theories of Rogers and Maslow, and behavioristic and social learning theories. The interplay between theory and research is also considered. One session per week, 3 credits.

47.272 Abnormal Psychology. An introduction to the study of various patterns of neurotic, psychotic, and character disorders. Therapeutic techniques and other auxiliary methods for the treatment of such disorders are studied in relation to contemporary theory and research. One session per week, 3 credits. Prerequisite: 47.101.

47.328 Dynamics of Interpersonal Relations. An analysis of psychological dynamics in interpersonal behavior, emphasizing such topics as conformity,leadership, interpersonal growth, self-disclosure, personal styles of interaction, and technique of change. The primary focus will be on the behavior of the students themselves who form a small group in which they are expected to participate. The course is taught without a formal prerequisite, but students should have some previous course work in psychology. One session per week, 3 credits.

47.364 Psychology of Crime and Corrections. An investigation of the psychological aspects of crime and deviance, and the nature of punishment and rehabilitation. Clinical case histories or criminal personalities will be combined with experimental studies of anti-social and violent behavior. The nature of prisons and criminal justice will also be examined. One session per week, 3 credits. Prerequisite: 47.272.

48.101 Introduction to Sociology. This is the basic course in sociology. Emphasis is directed at the ways in which social institutions such as government, schools, the economy, social class, and the family develop and influence our lives. It is concerned not only with presenting various ways to understand our relationship to society, but also with ways to change it. One session per week, 3 credits.

48.201 Social Anthropology. Using the comparative approach to the study of society, this course examines several distinct cultures as a means of understanding both the universal constants and the variations in human societies. One session per week, 3 credits.

48.231 The Sociology of the Family. A study of the nature of the family in contemporary society with particular emphasis on the family in America. What functions does the family perform in modern society? How is it changing? How do these changes affect our lives? One session per week, 3 credits.

48.296 Futuristics: Material Trends. An investigation of the technology-oriented society using science-fiction works of sociological importance and related scholarly texts to focus on such topics as population, ecology, man vs. the machine, the automobile in the future, and future cities. Preference to juniors. One session per week, 3 credits.

48.297 Futuristics: Social and Political trends. A continuation of 48.296 critiquing the technology-oriented society using science-fiction works of sociological importance and related scholarly texts to focus on such topics as slicing the economic pie, social order and control, prejudice, the generation gap, and our destiny. Preference to juniors. One session per week, 3 credits.

48.334 The Study of Minorities. This course examines the process of immigration and majority-minority relations in the U.S. over the last century with particular emphasis on the process of adaptation in a pluralistic society. One session per week, 3 credits. Prerequisite: 48.101.

48.341 Social Stratification. This course focuses on the phenomenon of social class distinctions with particular emphasis on social class in America. The approach taken is both historical and sociological. One session per week, 3 credits. Prerequisite: 48.101.

48.345 Urban Sociology. This course deals with issues related to the quality of life in American cities. Students taking this course may engage in research projects on the city of Lowell and the role of the University of Lowell within that city. One session per week, 3 credits.

48.351 The Sociology of Health and Health Care. A historical and contemporary study of the socio-politics of health, illness, and the health care industry in the United States. Attention is given to providers, consumers, owners, workers, and professionals in terms of their power, class, race, sex, and age. Reforms and alternatives are considered. One session per week, 3 credits. Prerequisite: 48.101 or permission of instructor.

48.356 Political Sociology. This course focuses on the development and use of power in modern society. Emphasis is placed on the relationship of American political institutions to economic institutions, to social class, and to supporting ideologies. One session per week, 3 credits. Prerequisite: 48.101 or permission of instructor.

AREA II: FINE ARTS AND THE HUMANITIES

41.205 History of Architecture. A study of period and personal architectural styles in the western world from ancient times to the present day. Emphasis on the roles of structural systems, geography, and social forces as formative elements. Includes field trips to examine local buildings. One session per week, 3 credits.

41.221 Twentieth Century Art. A study of American and European movements in painting, sculpture and architecture from 1900 to the present. Emphasis is placed on Fauvism, Cubism, International Style, Pop and Op Art. One session per week, 3 credits.

41.269 Aluminum Plate Lithography. An introductory course in aluminum plate lithography, covering such techniques as magazine transfer, gum blockout, tusche, lithograph crayon and chemical texture. Students will be encouraged to develop personal expression through the various techniques. One session per week, 3 credits.

41.281 Ceramics. Introduces the basic approaches to constructing creative ceramic pieces. Techniques will include slab, coil, pinch and the potter's wheel. Decorating and glazing methods will also be stressed. One session per week, 3 credits.

41.313 American Art. A study of American painting, sculpture and architecture from the Colonial Period to the end of the 19th Century seen in relation to European developments and American social and technological changes. Empasis is placed on New England architecture. One session per week, 3 credits.

41.375 Commercial Art. An introductory course in commercial techniques and their application to advertising. Creative problem assignments will aid the student in understanding and applying commercial skills. One session per week, 3 credits.

42.101 College Writing. This course will be concerned with the preparation of expository and argumentative essays, and with the critical reading of non-fiction; it will include a study of the techniques and documentation of research. One session per week, 3 credits.

42.102 College Writing and Literature. This course will be concerned with written and classroom work that reinforces the substance of 42.101. Imaginative literature representative of the major types will be studied as a basis for further developing competence in writing. One session per week, 3 credits.

NOTE: Before enrolling in any English course numbered 42.110 or higher, students must complete 42.101, 42.102 to fulfill the University requirement of 6 hours in composition.

42.111 Technical and Business Writing. A study of the theory and practice of letters, memoranda, and reports on specific business and technical problems. Registration preference for students enrolled in Business and Management programs. One session per week, 3 credits.

42.112 Technical and Scientific Writing. A study of theory and practice of letters, memoranda, and reports on specific scientific and technical problems. Registration preference for students enrolled in the Engineering Technology and Science programs. One session per week, 3 credits.

42.201 Great Books of Antiquity. Representative literary selections from the Bible, classical Greece and imperial Rome are studied as embodiments of ancient views of life and reality. One session per week, 3 credits.

42.203 Great Books of the Modern Period. Representative literary selections from the period of the Enlightenment to the present are studied as embodiments of modern views of life and reality. One session per week, 3 credits.

42.212 The Short Story. A study of the development of the genre. One session per week, 3 credits.

42.216 The Mystery Story. A study of the genre from Poe to the present. One session per week, 3 credits.

42.231 Literature and Mass Media I. A study of radio, journalism and early cinema, and their influence on contemporary literature. One session per week, 3 credits.

42.240 Literature and Women. A survey of literary attitudes towards women from the Judaic and Hellenic periods through the contemporary. One session per week, 3 credits.

42.242 The Heroine in Modern Fiction. A study of selected short stories and novels which deal sympathetically with the changing roles of women. One session per week, 3 credits.

42.245 The Businessman in American Fiction. A study of the businessman as hero in American fiction. One session per week, 3 credits.

42.246 The Rogue in Fiction. A study of the picaresque hero depicted by such writers as Cervantes, Defoe, Fielding, Cary, Donleavy, and Bellow, including attention to theories of comedy. One session per week, 3 credits.

42.250 The Bible as Literature. A literary and historical analysis of selected Old and New Testament books. One session per week, 3 credits.

42.252 The Literature of Hunting. A study of fictive, technical and philosophical works about hunting and fishing by such writers as Walton, Ortega y Gasset, Grey, Hemmingway, Faulkner, Bourjaily, and Woolner. One session per week, 3 credits.

42.253 The Literature of Sports. A study of the athlete as hero in selected novels, biographies and autobiographies. One session per week, 3 credits.

42.257 The Family in Literature. A study of literary selections dealing with traditions of family life and social change. One session per week, 3 credits.

42.267 Introduction to Shakespeare. A study of selected histories, comedies and tragedies. One session per week, 3 credits.

42.272 American Literature of the Twentieth Century. A study of twentieth century American short stories, novels, poetry and drama. One session per week, 3 credits.

42.273 British Literature of the Twentieth Century. A study of British short stories, novels, poetry, and drama. One session per week, 3 credits.

42.291 History of English Literature I. A study of the historical development of English literature from the beginnings to Milton. Selected works by representative authors from each period are studied. One session per week, 3 credits.

42.292 History of English Literature II. A study of the historical development of English literature from Dryden to the beginning of the twentieth century. One session per week, 3 credits.

42.293 History of American Literature I. A study of the historical development of American literature from the Colonial period to the Civil War. Selected works by representative authors from each period are studied. One session per week, 3 credits.

42.294 History of American Literature II. A study of the historical development of American literature from the Civil War to World War I. One session per week, 3 credits.

42.362 Modern Drama. A study of selected continental, British and American, plays of the late nineteenth century to the present. One session per week, 3 credits.

45.201 Introduction to Philosophy. An examination of some of the typical approaches to philosophical questioning and the issues raised in such inquiry: what is true knowledge, what is reality, what is the good, what is the right political order, what is the nature of religious faith? One session per week, 3 credits.

45.203 Logic and Philosophy. This course is devoted to an exploration of the implications of formal logic for the resolution of traditional philosophical questions concerning the nature of reality. The first half of the course will be spent in developing facility in the techniques of formal deduction. Subsequently, these techniques will be applied to the analysis of philosophical texts. Finally, logic, art and religion will be contrasted as offering different modes of access to being. One session per week, 3 credits.

45.205 Symbolic Logic. After a brief introduction to the priciples of propositional logic and elementary quantification, attention will be focused upon the nature of formal deductive systems, wherein a systematic development of the propositional calculus will first be presented, followed by the construction of a first-order function calculus. One session per week, 3 credits.

50.101 Beginning French I*. Development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than one year of French at the secondary level are ineligible for this course. One session per week, 3 credits.

50.102 Beginning French II*. A continuation of 50.101, which is a prerequisite. One session per week, 3 credits.

51.101 Beginning German I*. Development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than a year of German at the secondary level are ineligible for this course. One session per week, 3 credits.

51.102 Beginning German II*. A continuation of 51.101, which is a prerequisite. One session per week, 3 credits.

54.101 Beginning Spanish I*. Development of fundamental skills in oral expression, aural comprehension, reading and writing. Tapes available for laboratory use. Students who have completed more than one year of Spanish at the secondary level are ineligible for this course. One session per week, 3 credits.

54.102 Beginning Spanish II*. A continuation of 54.101, which is a prerequisite. One session per week, 3 credits.

* Beginning and intermediate language courses at the 101-102 and 211-212 levels must be elected for two consecutive semesters and in the prescribed sequence. College credit may not be granted for one semester of such courses unless exception is permitted by the Chairperson of the Department of Languages on the basis of student placement in a more advanced language course.

CLASS SESSION CALENDAR 1977-1987

FALL TERM

	Mon	Tues	Wed	Thurs	Fri
Aug	29 REGISTRATION	30	31	1	☒
September	☒	6	7	8	9 Mon Class Meets
	12	13	14	15	
	19	20	21	22	
	26	27	28	29	
October	3	4	5	6	
	☒	11	12	13	
	17	18	19	20	
	24	25	26	27	
November	31	1	2	3	4 Make Up
	7	8	9	10	☒
	14	15	16	17	
	21	22 Thurs Class Meets	23	☒	☒
	28	29	30	1	2 Make Up
December	5	6	7	8	9 Make Up
	12	13	14 EXAMS	15	
	19 EXAMS	20			

SPRING TERM

Mon	Tues	Wed	Thurs	Fri	
9 REGISTRATION	10	11	12		January
☒	17	18	19	20 Mon Class Meets	
23	24	25	26		
30	31	1	2		
6	7	8	9		February
13	14	15	16	17 Mon Class Meets	
☒	21	22	23		
27	28	1	2		
6	7	8	9		March
13	14	15	16		
20	21	22	23		
27	28	29	30	31 Make Up	
3	4	5	6	7 Make Up	April
10	11	12	13	14 Tues Class Meets	
☒	18 Mon Class Meets	19	20	21 Make Up	
24 EXAMS	25	26	27		
		3 Summer Registration	4		May
8 Summer Registration	9				

University of Lowell
Evening School
Cumnock Hall
Lowell, MA 01854

Third Class Mail